On the Construction of Life Tables, illustrated by a new Life Table of the Healthy Districts of England. By W. FARR, ESQ., M.D., F.R.S.

(Concluded from page 141.)

IV. CONSTRUCTION OF THE COLUMNS d_x, l_x, L_x, P_x, Q_x, Y_x, AND NOTICES OF SOME OF THEIR PRACTICAL APPLICATIONS.

THE series l_x has been constructed, and from that series others are deduced to complete the Life Table, consisting now of six columns.

(1.) $d_x = l_x - l_{x+1}$ = number of deaths in the year of age following, out of l_x alive at the age x. By taking x successively at 0, 1, 2, 3 . . . . to the last age in the Table, the numbers *dying* in every year of age are obtained. The numbers dying of the age x and under the age l_{x+n} are immediately derived from the column l_x, as (2) $l_x - l_{x+n} = d_x + d_{x+1} \dots d_{x+n-1}$. When $x+n > \omega$ = the oldest age in the Table, $l_x = d_x + d_{x+1} \dots + d_\omega$.

(3.) $L_x = l_x + l_{x+1} \dots\dots + l_\omega$. The series is formed by the successive addition of the series l_x, from l_ω upwards.

(3*a*.) $L_x - L_{x+n} = L_{x|n} = l_x + l_{x+1} \dots + l_{x+n-1}$.

(4.) $\left.\begin{array}{l} P_x = l_{x+1} + \frac{1}{2}d_x \\ P_x = l_x - \frac{1}{2}d_x \end{array}\right\}$ and (5) $P_x = \dfrac{l_x + l_{x+1}}{2}$.

$P_{x+1} = l_{x+1} - \frac{1}{2}d_{x+1} = l_{x+2} + \frac{1}{2}d_{x+1}$.

The series in column P_x is constructed from the two columns l_x and d_x, or from the single column l_x, as $2P_x = l_x + l_{x+1}$; and $\therefore P_x + \dfrac{l_x + l_{x+1}}{2}$, $\therefore l_x = 2P_x - l_{x+1}$; so, conversely, the series l_x can be constructed from the series P_x. The P_x is assumed to represent the population, as expressed by the Life Table, living at the age x and under the age $x+1$; thus P_{20} = the population of the age 20 and under 21 years.

By substituting the successive values of P_x in the equation (5*a*), $P_x + P_{x+1} \dots P_{x+n}$, we have $\frac{1}{2}l_x + l_{x+1} \dots + l_{x+n} + \frac{1}{2}l_{x+n+1}$.

(6.) $Q_x = P_x + P_{x+1} + P_{x+2} \dots P_{x+n-1} + P_{x+n} \dots + P_\omega \dots\dots$

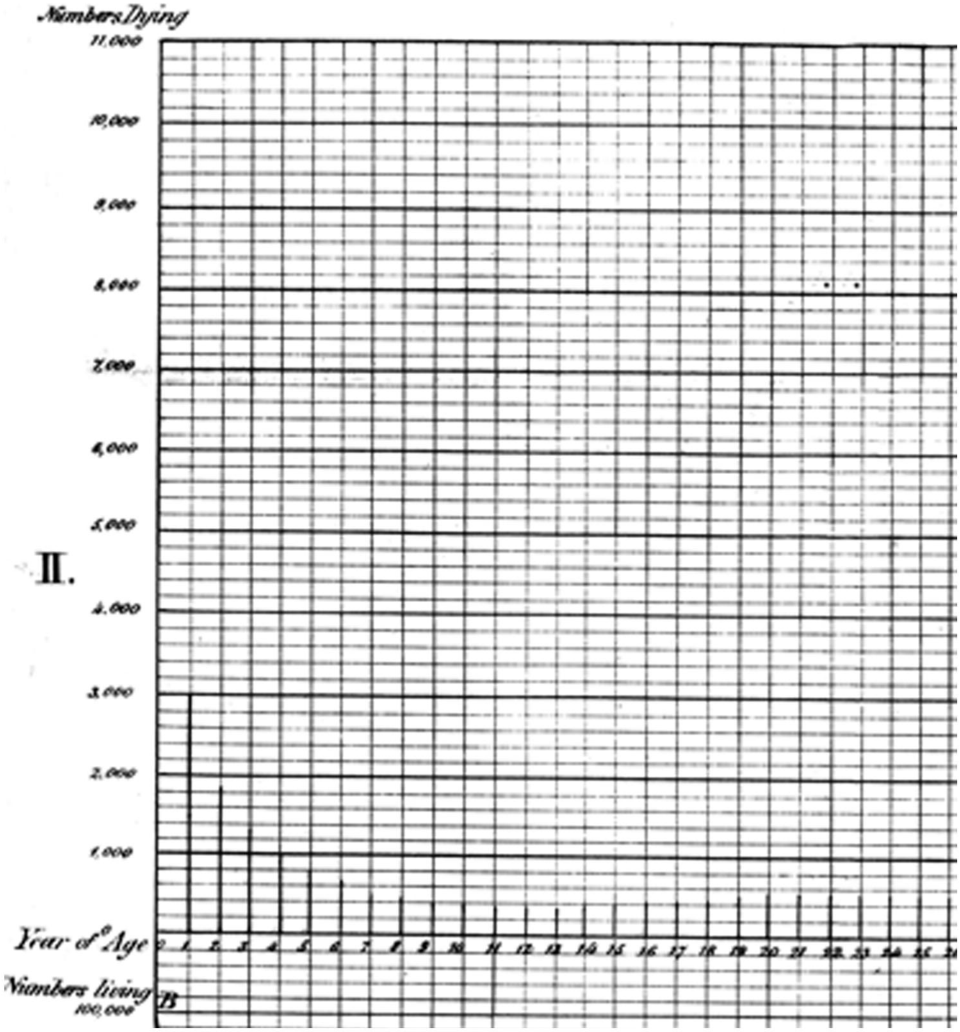
$Q_{x+n} = P_{x+n} + P_{x+n+1} + P_{x+n+2} \dots + P_\omega$.

(7.) $\therefore Q_x - Q_{x+n} = Q_{x|n} = P_x + P_{x+1} + P_{x+2} \dots P_{x+n-1}$. The column Q_x is constructed by adding up the column P_x, and transferring the successive sums to the column Q_x.

By substituting, for the series P_x, its values in l_x, we have—

(8). $Q_x = \frac{1}{2}l_x + l_{x+1} + l_{x+2} \dots\dots + l_\omega$.

II.


Numbers Dying
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
Year of Age
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Numbers living
100,000
B

HEALTHY DI

LIFE TABLE I

IEALTHY DISTRICTS.

E TABLE DIAGRAMS.

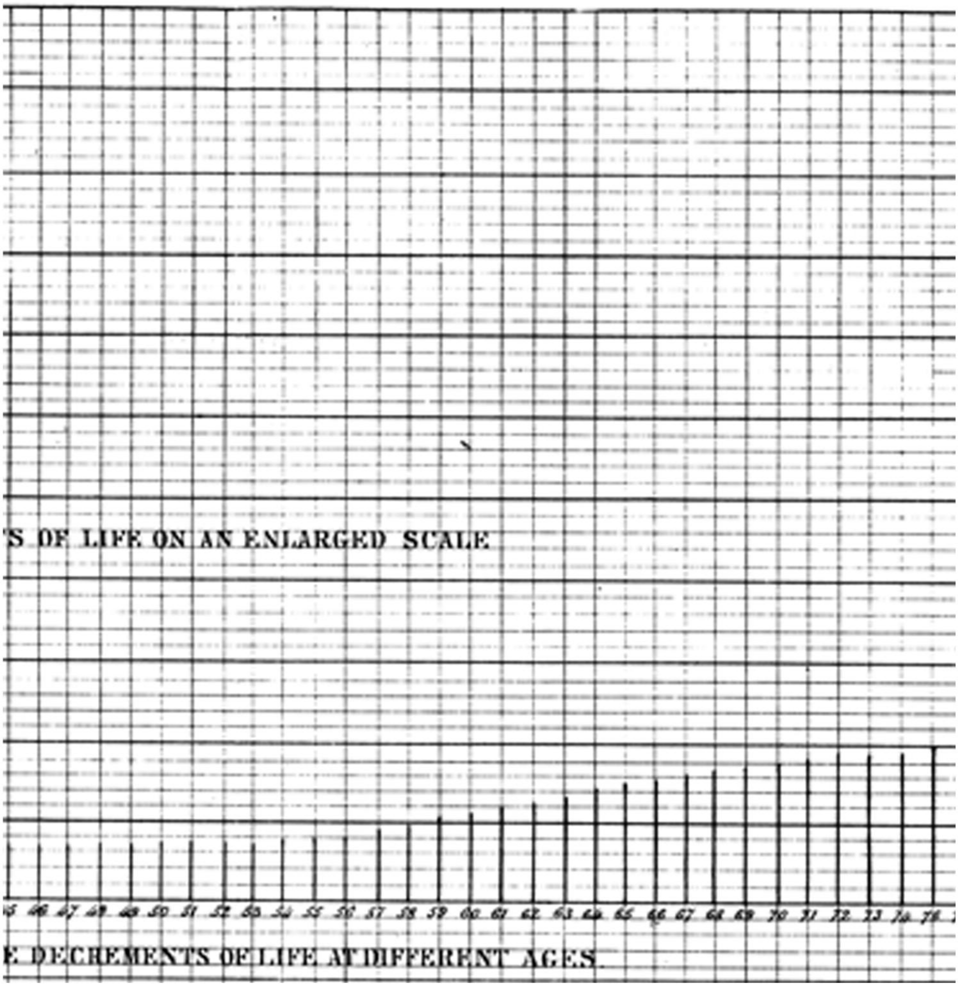
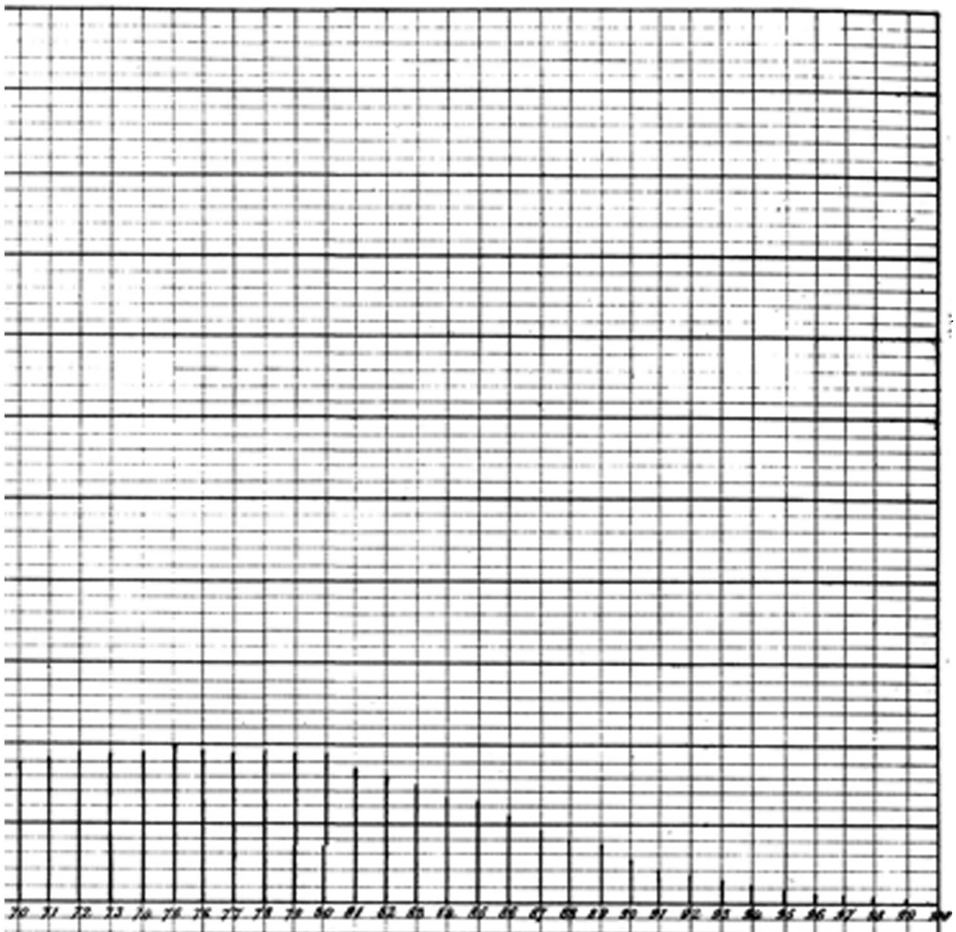
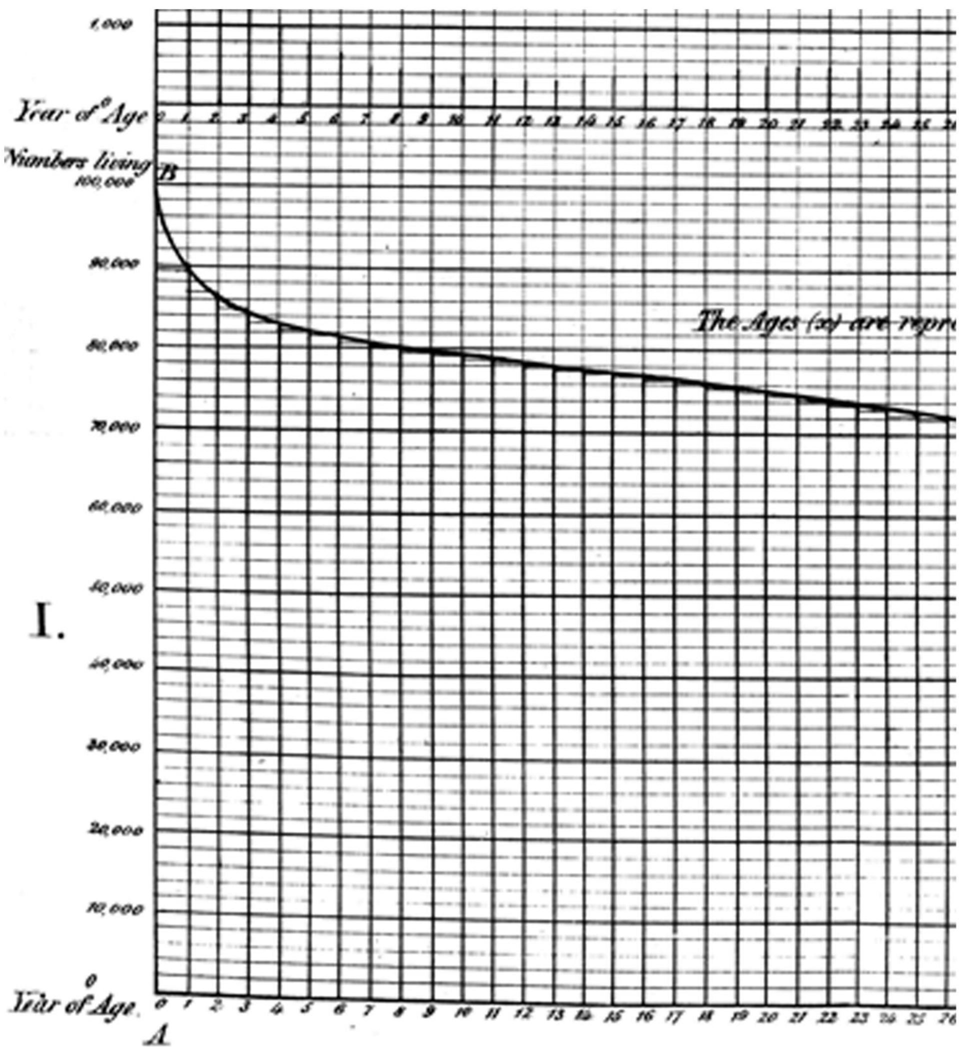
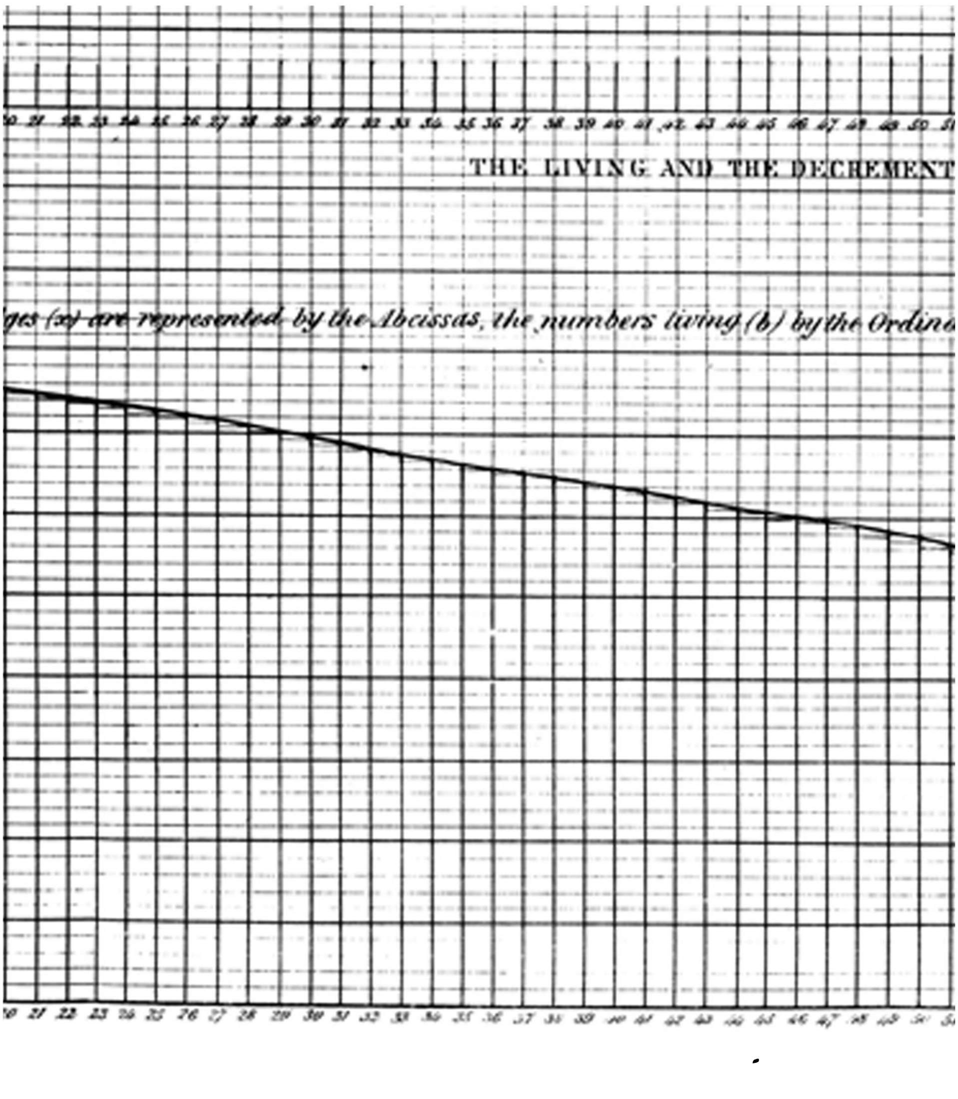


Plate XLII.

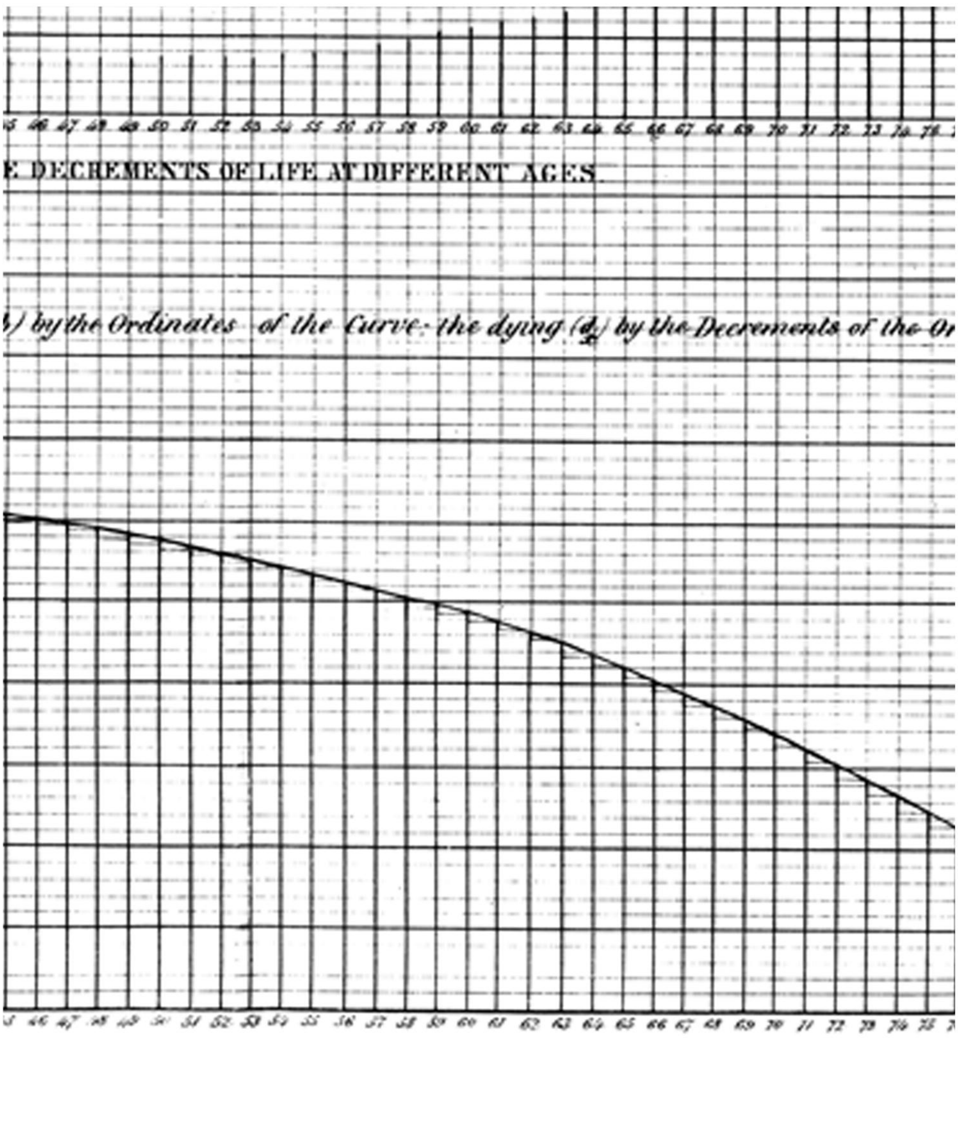


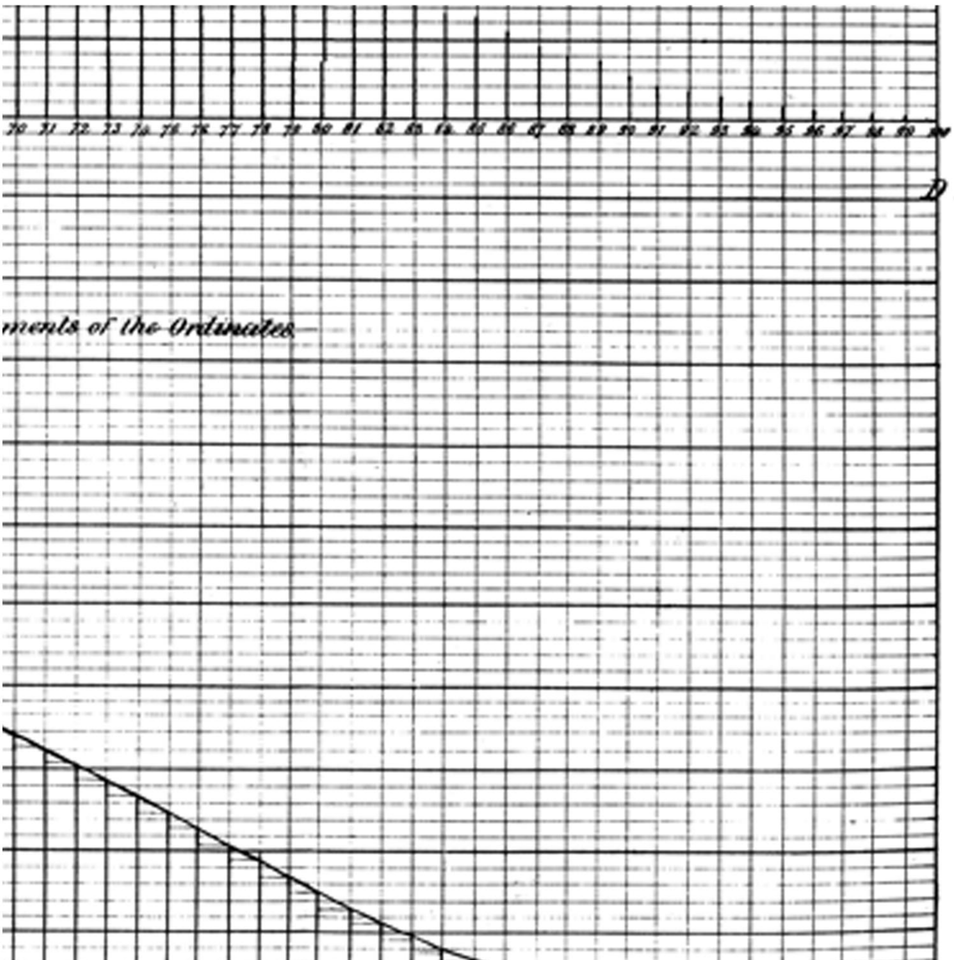


1,000
Year of Age
Numbers living
B
100,000
90,000
The Ages (x) are repr
80,000
70,000
60,000
50,000
I.
40,000
30,000
20,000
10,000
0
Year of Age.
A



THE LIVING AND THE DECREMENT
ges (x) are represented by the Abcissas, the numbers living (b) by the Ordina


46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
DECREMENTS OF LIFE AT DIFFERENT AGES.
by the Ordinates of the Curve: the dying
by the Decrements of the
46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75



C. & E. Layton lithe. Fleet St.

And by again substituting for the series l_x its corresponding values in d_x, we have—

(9.) $Q_x=\frac{1}{2}d_x+1\frac{1}{2}d_{x+1}+2\frac{1}{2}d_{x+2}\ldots\ldots+(\omega+\frac{1}{2})d_\omega$.

(10.) Thus Q_x is equal to the numbers dying in each year of age after the age x, multiplied by the time (expressed in years and fractions of a year) that they have respectively lived over that age; and if $x=0$, then $Q_0=\frac{1}{2}d_0+1\frac{1}{2}d_1+2\frac{1}{2}d_2\ldots\ldots(n+\frac{1}{2})d_{x+n}$, when $(x+n)$ becomes $>\omega$.

(11.) This column Q_x represents, therefore, two distinct orders of facts; it represents the sum of the number of years that will be lived after the age x by the l_x persons then living, and $\therefore \frac{Q_x}{l_x}=$ the mean after-lifetime, of which $\frac{Q_{x|n}}{l_x}$ will be enjoyed before the age $x+n$ is attained, and $\frac{Q_{x+n}}{l_x}$ after the age $x+n$ is attained. At birth the mean after-lifetime is $\frac{Q_0}{l_0}$, the unit here being one year of individual life.

(12.) Q_x also represents the sum of the numbers of men or women living at all ages over the age x, out of Q_0 living at all ages, as Q_x is in all cases the sum of the numbers living in each year of age, represented by the series P_x. The unit is here an individual man.

(13.) Thus, on referring to the Plate appended to this paper, the lifetime of 100,000 children born simultaneously may be represented by 100,000 parallel lines, drawn from AB horizontally in the direction of CD until they cut the curved line BC. And Q_0 is the sum of these lines expressed in the linear units of the scale on the line AC; so $\frac{Q_0}{l_0}=\frac{Q_0}{100{,}000}=\frac{4{,}899{,}665}{100{,}000}=48{\cdot}99665$; the mean length of those lines = the number of years of mean lifetime.

It will be observed that, in this Table, instead of 100,000 lines, these lines are thrown into 106 groups, each comprising the variable number of lines terminating in each of 106 intervals numbered on the line AC, and representing years of age; and in these short intervals it is assumed that the mean length of the lines terminating in the eleventh interval (10 to 11) is represented by $10\frac{1}{2}$, and so on.

The relative numbers of persons living simultaneously at each interval of age will also be represented in the same Plate, fig. 1, by 106 successive vertical lines, raised from nearly the centre of each

interval between the ordinates on the line AC, and measured in units of which the line AB contains 100,000. The same lines bound the figure representing the two orders of facts, and the numerical units expressing the aggregate length of the vertical lines equal in amount the units expressing the aggregate length of the horizontal lines expressed in the horizontal units.

(14.) I will now explain briefly the nature of the column Y_x, which I have added to the Life Table.* The Life Table (column P_x) exhibits a representative population, such as would be constituted by separating every year 100,000 births as they occurred, and keeping them apart in a separate community, subject to a definite law of mortality. Any population living in the tabular proportions at each year of age may, for the sake of distinction, be called a normally-constituted population.

The ages of the population represented by the Life Table amount, in the aggregate, to Y_0 years; it is the aggregate *number of years which they have already lived*, and, singularly enough, it is also, if the law of mortality remain constant, *the number of years which they will live*. Thus, Q_0 persons in such a population have lived on an average $\frac{Y_0}{Q_0}$ years; *that is their* MEAN AGE, and it is also their mean *after-lifetime*. Y_x is the number of years that Q_x persons have lived *over the age x*, and the mean age of such persons is $x+\frac{Y_x}{Q_x}$; their after-lifetime is $\frac{Y_x}{Q_x}$.

The series Y_x is formed by successively adding up a series of the form $\frac{1}{2}(Q_x+Q_{x+1})$, commencing at $x+1=\omega=$the oldest age in the Table.

$$(15.)\ \therefore\ Y_0=\tfrac{1}{2}Q_0+Q_1+Q_2\ldots+Q_\omega,$$
$$Y_x=\tfrac{1}{2}Q_x+Q_{x+1}+Q_{x+2}\ldots+Q_\omega.$$

* *See* paper in Appendix to *Registrar-General's Sixth Annual Report*, pp. 544-552.

Extract from the Registrar-General's Sixth Annual Report (1845), p. 528.

"*Note.*—Halley's Table (1693) contained the column P. John Smart made 1,000 'born' the basis of his Table (1738), and introduced the columns *d* and *l*. Simpson adopted Smart's form of Table, which was followed by Kersseboom (1738), Deparcieux (1746), Price (1773), and Milne (1815). The columns S.*y*, *y*, and Δ*y*, in Duvillard's *Loi de Mortalité (en France) dans l'état naturel*,† correspond with the columns L, *l*, *d*, in the new Table. The S.*y* added by Duvillard is our L, and Barrett's column B. Duvillard's short Table (p. 123) has the four columns *d*, *l*, P, Q, for quinquennial or decennial ages, and the 'expectation of life.' Mathieu's Table II. is an expansion of the column Q of Duvillard's short Table, and is that column for each year of age. In a recent report on the Bengal Military Fund, Mr. Davies has a Table (1) containing columns corresponding with the *d*, *l*, L, P, Q, of the English Table, the 'Mortality per cent.', and the 'Expectation of Life' at each age."‡

I have in this paper employed *d*, *l*, L, instead of C, D, N, which have been formerly used by me and others, and should still be used where the factor v^x is introduced.

† *Influence de la Petite Vérole*, p. 161. ‡ *See* the Note (A), p. 558.

By substituting for Q_0, for Q_1, for Q_2, and so on, their values in P_x, it will be found that—

(16.) $Y_0 = \frac{1}{2}P_0 + 1\frac{1}{2}P_1 + 2\frac{1}{2}P_2 + 3\frac{1}{2}P_3 \ldots\ldots + (n+\frac{1}{2})P_n \ldots\ldots + (\omega+\frac{1}{2})P_\omega$.

(17.) But the mean age of the persons (P_0) of the age of 0 and under 1 is nearly $\frac{1}{2}$; and so the series $\frac{1}{2}$, $1\frac{1}{2}$, $2\frac{1}{2}$, $3\frac{1}{2}$, $4\frac{1}{2}$, $5\frac{1}{2}$, $6\frac{1}{2} \ldots\ldots (n+\frac{1}{2})$, expresses nearly the mean age of all the persons in the first (P_0), second (P_1), third (P_2), and $(n+1)$th (P_n) years of age, and so for all other ages; consequently the sum of the series (16) Y_0 is the sum of the ages of all the persons living contemporaneously, as they are represented in the Life Table.

In like manner it is shown that—

(18.) $Y_x = \frac{1}{2}P_x + (1+\frac{1}{2})P_{x+1} + (2+\frac{1}{2})P_{x+2} \ldots + (\omega+\frac{1}{2}-x)P_\omega$ is the sum of the number of years that the Q_x persons in the Table have lived over the age x. They have all lived x years; and, consequently, $x + \frac{Y_x}{Q_x}$ gives their average age precisely as $\frac{Y_0}{Q_0}$ gives the average age of the whole community.

(19.) It has been shown that Q_x expresses the number of years that l_x persons will live; in the same manner it may be shown that Q_{x+1} expresses the number of years that l_{x+1} persons will live; $\therefore (l_x + l_{x+1})$ persons will live $(Q_x + Q_{x+1})$ years, $\therefore \frac{1}{2}(l_x + l_{x+1}) = P_x$ persons will live $\frac{1}{2}(Q_x + Q_{x+1})$ years. And the same may be demonstrated for each successive value of x.

But the sum of the series P_x is Q_x=the number of persons living of all ages; and the sum of the series $\frac{1}{2}(Q_x + P_{x+1})$ is Y_x= the number of years that Q_x persons will live; $\therefore \frac{Y_x}{Q_x}$=the *mean after-lifetime* of all the persons living simultaneously of the age x and upwards. Thus, by the Table D, 4,899,665 persons are living contemporaneously; their mean age is $\frac{Y_0}{Q_0} = \frac{166209701}{4899665} = 33{\cdot}92$ years, and they will life on an average 33·92 years.

(20.) The Life Table serves to determine the value of life annuities, the value of policies, and the premiums of insurance.

This is effected by introducing a new unit, such as £1, 1 franc, 1 dollar, or any other monetary unit. Thus, if £1 is payable at each death, the series d_x will show the number of pounds falling due in each year of age; so if £1 is payable by each person on attaining the age x, and each subsequent year of age, the series l_x shows the number of *pounds* payable every year by the l_x persons; and N_x will be the number of pounds payable in the whole course

of life after the age x: thus $\frac{N_x £1}{l_x}$ = the AVERAGE AMOUNT of an annuity of £1 payable on each life at and after the age x. The money-unit may be introduced into the other columns, and $\frac{Y_x}{Q_x}$. £1 would show the AVERAGE AMOUNT payable under an annuity of £1 on each of Q_x lives. The *present value* of these future payments can always be determined by assuming a given rate of interest. The estimates thus obtained are also always read subject to the qualification that, by hypothesis, the *Life Table* is based on a law of mortality actually to rule for a definite time in the population to which it is applied. The probability of the hypothesis is not here in question.

Under the same circumstances, masses of mankind appear to experience, at the same ages, the same rates of mortality; consequently, if, for several years, d_x persons have died annually on an average out of l_x persons living at the beginning of the year, other things being equal, the probability that the same number will die out of l_x persons in a year to come is greater than any other that can be named, and the fraction expressing that probability is $\frac{d_x}{l_x}$. We know that d_x expressing the numbers dying in a year, l_{x+1} must express the numbers surviving as $l_{x+1}+d_x=l_x$. The chances may be represented by l_x balls: l_{x+1} *white* balls in an urn will represent the chances of living, d_x *black* balls in the same urn will represent the chances of dying. Now, let each of l_x persons pay the sum z for a ticket, and each person that draws a *white* ball be entitled to £1. Before the drawing commences the value of each ticket is $\frac{l_{x+1}}{l_x}$; for l_x (the total chances) : l_{x+1} (the chances in favour of winning on one ticket) :: $1 : \frac{l_{x+1}}{l_x} = z$.

Put $l_x=30{,}007$, and $l_{x+1}=29{,}647$; then $\frac{l_{x+1}.£1}{l_x} = \frac{29{,}647.£1}{30{,}007}$ $=£\cdot98802$. The amount of money to be paid on l_{x+1} white balls is £29,647, and £·9802 × 30,007 $=z.l_x=$ £29,647.

In like manner it may be shown that if £1 is paid to each person who draws a *black* ball, the value of each ticket is $\frac{d£1}{l_x}=y£1$, for $y.l_x.£1=d_x£1$, and £1 is to be paid on each of d_x tickets.

Should £1 be paid alike to those who draw white balls and to those who draw black balls, the value of a ticket will be equal to

the sum of the two fractions expressing the several probabilities, namely—

$$\frac{l_{x+1}.£1}{l_x}+\frac{d_x£1}{l_x}=z+y=\frac{l_{x+1}+d_x}{l_x}£1=\frac{l_x}{l_x}£1=£1.$$

As one or other of the two kinds of balls *must by hypothesis be drawn,* and £1 is paid for each ball, the receipt of the £1 is certain: certainty is thus in all cases expressed by *unity.*

If every ball as it was drawn were replaced in the urn, although in 30,007 trials *white balls* were not actually drawn 29,647 times, black balls 360 times, still $\frac{29{,}647}{30{,}007}$ would express the probability of drawing a white ball, and the value of £1 contingent on that event, more accurately than any other fraction that could be named.

Again, if an urn contained, by hypothesis, an indefinite number of balls, out of which 29,647 white balls and 360 black balls were drawn and then replaced, the probability of again drawing a white ball on trial, and the value of £1 contingent on that event, would be expressed more accurately by $\frac{29{,}648}{30{,}009}$* than by any other fraction that could be named—past experience being, by hypothesis, the only means we have here of judging of the future.

Thus a Life Table applicable to the case furnishes the fractions to determine the value of any sums of money dependent on the life or death of a given person, or a certain number of given persons in a given time.

The probability of living two years, expressed by the fraction $\frac{l_{x+2}}{l_x}=\frac{l_x-(d_x+d_{x+1})}{l_x}$, is less than the probability of living one year.

Making n any number of years and fractional parts of years, the fraction $\frac{l_{x+n}}{l_x}$ will invariably express the probability of living n years after the age x. As n approaches zero, the fraction will approximate to 1, the symbol of certainty—thus a person is more likely to live a day than a year, a minute than a day. As n increases, l_{x+n} diminishes in value; and when $x+n$ expresses a year after the age ω in the Life Table, $l_{\omega+1}$ is, by hypothesis, zero, $\therefore \frac{l_{\omega+1}}{l_x}=\frac{0}{l_x}=0$. The chance of living so long is expressed in this

* The addition of 1 to the numerator, and of 2 to the denominator, may be neglected, when, as in this case, the numbers are large.

case by zero; the chance of dying in the time by 1, the symbol of certainty.

(21.) l_{x+n} expresses the number of chances in favour of surviving n years, and $l_x - l_{x+n}$ the number of chances of dying in the same time—the sum of the two together (l_x) expressing the total number of chances. Thus the fraction $\left(\frac{l_{x+n}}{l_x}\right)$ expressing the probability of living a given time ranges from 1 to 0, and $\frac{l_x - l_{x+n}}{l_x} = 1 - \frac{l_{x+n}}{l_x}$, or the chance of dying in a given time, also ranges from 1 to 0 as n varies. When the two fractions are equal $\frac{l_{x+n}}{l_x} = \frac{l_x - l_{x+n}}{l_x}$, then $l_{x+n} = l_x - l_{x+n}$ and $2l_{x+n} = l_x$, $\therefore l_{x+n} = \frac{l_x}{2}$.

To verify the equations, an age $x+n$ must be chosen at which l_{x+n} is exactly equal to $\frac{1}{2}l_x$. Thus, by the Life Table of healthy districts, 100,000 children born alive are reduced to 50,851 in 58 years, and to 49,895 in 59 years; so the chances are rather in favour of their living 58 years, as they are 50,851 to 49,149; upon the other hand, the chances of their living 59 years (49,895) are less than the chances 50,105 of their dying before attaining that age. Upon trial it will be found that the chances of living to and of dying before $58\frac{851}{956}$ years $= 58 + \frac{50{,}851 - 50{,}000}{d_{58}} = 58 + \frac{851}{956}$ years, or about $58\frac{8}{9}$ years, are nearly equal; hence this is called the *probable lifetime*, or *vie probable* by French writers, for $\frac{l_{58\frac{8}{9}}}{l_0} = \frac{1}{2}$. At the age 20 the probable lifetime is $47\frac{1588}{1638}$, nearly 48 years. The probable lifetime at every age is immediately seen by inspection.

(22.) V. THE THREEFOLD LIFE TABLE—PERSONS, MALES, FEMALES.

The Life Table is threefold: a table having the six columns is made for males, another table is separately made for females; the several columns of the two tables incorporated together form the Table of Persons, which has 100,000, and may have any other number, for its basis. The basis of the Male Table in the illustration is 51,125, while the basis of the Female Table is 48,875. In that proportion males and females were born in the districts. Under this arrangement the number of contemporaneous males and females living at each age in column l_x is shown—thus, 38,388 males and 37,212 females attain the age of 20; 17,145 males

attain the age of 70, and 17,133 females attain the same age. At all ages under 71 the number of males exceeds the females; at the age of 71 and upwards the females exceed the males in number; and upon referring to the columns d_x, it will be seen that the males die off in greater number than females after the age of 42. The age after the second year at which the greatest number of deaths occur is 75 in males, 76 in females.

These numbers all refer to the Life Table for Healthy Districts.

Some of the other properties of the Life Tables, admitting of innumerable applications in the solution of social phenomena, will appear in the following formulæ, which will be found useful in practice.

VI. USEFUL FORMULÆ.

The following formulæ will facilitate the use of the Life Table. The figures must be taken from the Tables of Persons, of Males or Females, applicable to the case. The formulæ are general, and are applicable to any other Life Table.

(23.) $\frac{d_x}{P_x} = m_x =$ the rate of mortality in the year of age following the precise age x.

(24.) $\frac{d_x}{l_x} = \frac{l_x - l_{x+1}}{l_x} = 1 - \frac{l_{x+1}}{l_x} =$ the probability that a person A, of the age x, in average health, will die in the following year.

(25.) $\frac{l_{x+1}}{l_x} = p_x = \frac{l_x - d_x}{l_x} = 1 - \frac{d_x}{l_x} =$ the probability that A, a person of the age x, will live a year; $\therefore 1 - p_x =$ the probability that A, age x, *will die in the year following*, as certainty of life $= 1$.

(26.) $\frac{l_x - l_{x+n}}{l_x} =$ the probability that A, age x, will die in the next n years.

(27.) $\frac{l_{x+n}}{l_x} =$ the probability that A, of age x, will live n years.

(28.) Put $\frac{l_x}{2} = l_{x+n}$, and when l_{x+n} is taken at such an age as to fulfil the conditions of the equation, then n is the *probable lifetime* $=$ *vie probable* $=$ the time that it is an even chance a person of the age x will live.

(29.) $\frac{Q_x}{l_x} = A_x =$ the mean *after-lifetime*, or, as it is often called, the *expectation of life*—an incorrect expression, which is rather applicable to the probable lifetime.

Note.—Upon Demoivre's hypothesis, the *probable lifetime*—that is, the time that a person may fairly expect to live, his *expectation*—was the same as the mean after-lifetime.

(30.) $G_x = x + A_x =$ the mean age at death of persons who have already lived exactly x years.

(31.) $S = c\frac{Q_{x|n}}{l_x} =$ the number of members of any Society between the ages x and $x+n$, which will be permanently sustained by c . . . annual admissions at the age x.

(32.) $c = \frac{Sl_x}{Q_{x|n}} =$ annual recruits of the Society (S).

(33.) $\frac{Sl_{x+n}}{Q_{x|n}} =$ annual members leaving the Society (S) on attaining the age $x+n$.

(34.) $\frac{Sl_{x|n}}{Q_{x|n}} \doteq$ annual deaths in such a Society (S).

(35.) $S\frac{Q_{x+n}}{Q_{x|n}} =$ the aggregate number of persons living who have left such a Society as pensioners or otherwise.

In the following formulæ it is assumed that the population is normally constituted.

(36.) $\frac{Y_x}{Q_x} = A'_x =$ the mean after-lifetime of all persons of the *age x and upwards.*

(37.) $\frac{Y_x - Y_{x+n}}{Q_x - Q_{x+n}} = \frac{Y_{x|n}}{Q_{x|n}} =$ the mean after-lifetime of all persons of the age of x and under the age of $x+n$.

(38.) $c.\frac{Y_{x|n}}{Q_{x|n}} =$ the number of persons of which a Society will *ultimately consist*, recruited by c annual additions of members in the tabular proportions between the age x and $x+n$.

(39.) $c\frac{Y_{x|n} - Y_{x+m|n}}{Q_{x|m}} =$ the number of persons to which a Society joined by c persons of the tabular ages x and under $x+m$ would amount in n years. When $x+n > \omega$, this formula will be reduced to the same form as equation (38); and when $x+m$, as well as $x+n > \omega$, the equation becomes the same as (36).

VII. LIFE TABLE OF THE SIXTY-THREE HEALTHIEST ENGLISH DISTRICTS.

Upon inquiry it was found that in many districts of England the mortality of the population did not exceed the rate of 17 annual deaths to 1,000 living.

For the sake of convenience these were called "healthy districts," consisting of sixty-four, or nearly a tenth part of the total registration districts of England and Wales, and inhabited by nearly a million of people. Sixty-three of these districts have been taken as the basis of the new Life Table, constructed according to the methods previously described.

It will be seen that these districts, generally conterminous with Poor Law Unions, are distributed over the various parts of the country. They comprise:—*Hendon* (with Harrow*) (17), *Lewisham* (17), and *Bromley* (17), in the neighbourhood of London; *Hambledon* (16), *Dorking* (17), *Reigate* (16), and *Godstone* (17), on the southern slope of the Surrey hills; *East Ashford* (17), in East Kent; *Blean* (including Herne Bay) (17), between Canterbury and the sea. Ten districts of Sussex—*Battle* (16), near Hastings; *Eastbourne,* around Beachy Head (15); *Hailsham* (17), *Uckfield* (17), *East Grinstead* (17), *Cuckfield* (16), *Steyning,* near Brighton, (16); *Petworth* (17), *Worthing* (17), and *Midhurst* (17). Seven districts of Hampshire—The *Isle of Wight,* separated from the mainland by the sea (17); *Lymington* (17), *Christchurch* (16), *Ringwood* (17), *New Forest* (17), *Catherington* (17), and *Alresford* (17). *Wokingham* (17), and *Easthampstead* (16), in Berkshire, south of the Thames; *Ongar* (17), in Essex, east of Epping Forest; *Mutford* (17), including Lowestoft, on the Suffolk coast; *Henstead* (17), south of Norwich; *Kingsbridge* (17), on the south coast of Devon; *Okehampton* (16), *Crediton* (17), *Barnstaple* (17), *Torrington* (17), *Bideford* (17), *Holsworthy* (16), stretching from the centre over Dartmouth and Exmoor, along the coast of the Bristol Channel; *Stratton* (17), *Camelford* (17), and *Launceston* (17), in the adjacent parts of Cornwall, and, further south, *St. Columb* (17); *Williton* (17), in Somerset, also on the Bristol Channel; *Winchcomb* (17), to the east of Cheltenham and the Cotswold Hills around the sources of the Thames; *King's Norton* (17), in Worcestershire, adjoining Birmingham; *Melton Mowbray* (17), in Leicestershire; *Southwell* (17), about Sherwood Forest, in the centre of Nottinghamshire; *Garstang* (16), in Lancashire, looking northward over Lancaster Bay; *Easingwold* (17), in the North Riding of Yorkshire; *Guisborough* (16), on the eastern coast north of Whitby. Then follow five border districts of Northumberland on the southern face of the Cheviot Hills—*Belford* (17), *Glendale* (15), *Rothbury*

* The annual deaths to 1,000 living of all ages, inserted in parentheses, are deduced from returns of the living at the Censuses of 1841 and 1851, and the deaths registered in the ten years 1841 to 1850. (*See* Registrar-General's *Sixteenth Report*, pp. 141 to 153.)

(15), *Bellingham* (17), *Haltwhistle* (16) (is omitted in the Table), *Longtown* (17) and *Brampton* (17) on the border, and *Bootle* (16) on the coast of Cumberland; the *East Ward* (17) of Westmoreland; *Haverfordwest* (17), on the western point of South Wales; *Builth* (16), *Corwen* (17), *Pwllheli* (17), on Carnarvon Bay, and *Anglesey* (17) complete the list. These districts, and others nearly equally healthy, have been thus described:—

"Such is the variety of the soil of England, that, tested by the rates of mortality, the children reared out of a given number born, the longevity of the inhabitants, the freedom from common epidemics, or the immunity from cholera, healthy districts are found in nearly every county. Large tracts of country are, however, so much healthier than the rest, that they may be justly called Salubrious Fields; and it is remarkable that here the finest races of animals are bred. The north districts of Northumberland, around the beautiful Cheviot Hills, covered with grasses, ferns, and wild thyme, extending from the region of the heaths to the rich cultivated land at their bases, touching each other or intersected by narrow valleys—the districts extending from the Tees, over the North and East Ridings of York, to Leicestershire, Herefordshire, and parts of Shropshire—some of the districts of Gloucestershire about the Cotswold Hills—parts of Wales—North Devon, including Dartmoor and Exmoor—the Surrey and Sussex hills, with the Southdowns—have given names to the best breeds of sheep, fowls, cattle, and horses in the kingdom. . . . . .

"The dry and most inland are not always the healthiest regions of the country. The salubrious fields are sometimes watered by running streams, and diversified by lakes. The dew is abundant. They are often veiled, not by infectious fogs, but by mists drawn from the sky as it breathes over them. The mountains rise above, the ocean rolls at the distance below them, as on the coast of Sussex, North Devon, the western region of Wales, extending under Snowdon and Cader Idris in a vast amphitheatre round Cardigan Bay—the lake land and moors of the North, rising between the Irish Sea and the German Ocean. The land is sometimes heathy, but may be covered by the sweetest herbage, and bees feeding on the flowers. The cereal grains, the hop, the timber, are often of the finest quality. The animals are healthy, the native breeds are vigorous, and those fine varieties are produced at intervals which men of the genius of Bakewell, Ellman, Tomkins, Colling, and O'Kelly, make the permanent stock of the country. Industry and the army receive their best recruits from the population, while they get their worst from the people of the low parts of sickly towns. Agriculture has reclaimed many unhealthy districts on the plains, so that a considerable extent of the cultivated land is now in a state of comparative salubrity; and vast systems of drainage have subdued the noxious fens, although carried out less efficiently than is desirable, and interfered with by milldams on the rivers, descending like the Nene from the inland high lands."*

The sanitary condition of the people in these districts is, however, still in many respects defective.

* *Report to the Registrar-General on Cholera*, pp. xcv., xcvi.

CONCLUSION.

Halley first pointed out the financial applications of the Life Table, and first calculated the values of life annuities. That branch of science, in the various forms of life insurance, has since received great developments. The new Table shows that the duration of life, among large classes of the population, by no means in unexceptionable sanitary conditions, exceeds the term of the ordinary tables, and proves that life annuities cannot be sold advantageously by Offices, or by the Government, to large classes of lives, for less than the values deducible from the new Table.

A new branch of science has been developed since Halley's day: it is the science of public health—and here a new application of the Life Table is found.

It is probable, upon physiological grounds, that man goes through all the phases of his natural development in a hundred years; and that the period of active life seldom extends beyond eighty years. But this is a very indefinite measure, as the rates of mortality in all the intermediate ages are left undetermined after it has been ascertained in what proportions men attain the extreme limits.

Generations of men, under all circumstances, die at all ages; but the proportions vary indefinitely under different conditions, from a slight tribute to death each year, down to the point of extermination by pestilence. If we ascertain at what rate a generation of men dies away under the least unfavourable existing circumstances, we obtain a standard by which the loss of life, under other circumstances, is measured; and this I have endeavoured to determine in the Life Table of English Healthy Districts. And recollecting that the science of public health was almost inaugurated in England by a former president of this Society,* who encouraged and crowned the sanitary discoveries of Captain Cook, I feel assured that it will receive with favour this imperfect attempt to supply sanitary inquirers with a scientific instrument.

In a subsequent paper I hope to be able to lay before the Society the mortality by different kinds of diseases at each age, as they have been deduced from the same series of observations.

* Sir John Pringle.

HEALTHY DISTRICTS.

TABLE A.—*Population,* 1851—*Deaths in the Five Years* 1849 *to* 1853—*Average Annual Mortality per Cent., and Logarithms of the Mortality.*

AGES.	POPULATION.			DEATHS.			AVERAGE ANNUAL MORTALITY TO 100 LIVING (m).			LOGARITHMS OF THE MORTALITY (λm).		
	Persons.	Males.	Females.	Persons.	Males.	Females.	Persons.	Males.	Females.	Persons.	Males.	Females.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
All ages ..	996,773	493,525	503,248	87,345	43,736	43,609	1·753	1·772	1·733	$\bar{2}$·2436718	$\bar{2}$·2485599	$\bar{2}$·2388240
Under 5 ..	130,635	65,700	64,935	26,361	14,282	12,079	4·036	4·348	3·720	$\bar{2}$·6059323	$\bar{2}$·6382536	$\bar{2}$·5705821
5-	122,406	61,733	60,673	4,209	2,080	2,129	·688	·674	·702	$\bar{3}$·8374062	$\bar{3}$·8285759	$\bar{3}$·8462102
10-	110,412	56,651	53,761	2,377	1,087	1,290	·431	·384	·480	$\bar{3}$·6340429	$\bar{3}$·5840519	$\bar{3}$·6811523
15-	181,339	90,066	91,273	6,603	3,113	3,490	·728	·691	·765	$\bar{3}$·8622801	$\bar{3}$·8396482	$\bar{3}$·8835130
25-	136,892	65,422	71,470	5,869	2,675	3,194	·857	·818	·894	$\bar{3}$·9332160	$\bar{3}$·9126300	$\bar{3}$·9512411
35-	108,056	52,734	55,322	5,208	2,447	2,761	·964	·928	·998	$\bar{3}$·9840521	$\bar{3}$·9675733	$\bar{3}$·9991985
45-	85,244	42,383	42,861	5,252	2,698	2,554	1·232	1·273	1·192	$\bar{2}$·0906909	$\bar{2}$·1048802	$\bar{2}$·0761886
55-	62,857	31,105	31,752	7,001	3,568	3,433	2·228	2·594	2·162	$\bar{2}$·3478365	$\bar{2}$·3606246	$\bar{2}$·3349327
65-	39,453	18,860	20,593	10,313	5,173	5,140	5·228	5·486	4·992	$\bar{2}$·7183350	$\bar{2}$·7392308	$\bar{2}$·6982734
75-	16,737	7,718	9,019	10,297	4,946	5,351	12·304	12·817	11·866	$\bar{1}$·0900631	$\bar{1}$·1077793	$\bar{1}$·0743066
85-	2,614	1,097	1,517	3,581	1,555	2,026	27·399	28·350	26·711	$\bar{1}$·4377287	$\bar{1}$·4525536	$\bar{1}$·4266838
95 & upwds.	128	56	72	274	112	162	42·813	40·000	45·000	$\bar{1}$·6315706	$\bar{1}$·6020600	$\bar{1}$·6532125

Note.—The ages at death of 146 persons—viz., 123 males and 23 females—were not stated; in calculating the mortality they have been distributed proportionally over the several ages in the Table. The Table may be read thus:—136,892 persons (of whom 65,422 were males, 71,470 were females at the age of 25 and under 35) were enumerated in 1851; at the same ages, 5,869 (2,675 males and 3,194 females) died in the five years 1849 to 1853; consequently the annual rates of mortality per cent. were ·857, ·818, and ·894.

Number of Deaths, at Five Periods of Age, in the Healthy Districts, in 1848 *to* 1855.

YEARS.	AGES.														
	Persons.					Males.					Females.				
	0.	1.	2.	3.	4.	0.	1.	2.	3.	4.	0.	1.	2.	3.	4.
1848	2,935	832	458	371	312	1,678	442	244	204	162	1,257	390	214	167	150
1849	2,932	858	541	427	292	1,637	452	263	207	154	1,295	406	278	220	138
1850	2,969	859	466	331	301	1,676	453	231	164	144	1,293	406	235	167	157
1851	3,185	932	543	341	288	1,769	502	274	179	148	1,416	430	269	162	140
1852	3,405	860	567	389	297	1,913	446	273	206	140	1,492	414	294	183	157
1853	3,370	946	554	376	287	1,888	514	293	179	137	1,482	432	261	197	150
1854	3,404	1,047	601	386	311	1,903	539	317	197	165	1,501	508	284	189	146
1855	3,350	907	533	445	297	1,948	483	257	230	156	1,402	424	276	215	141

Number of Births in Sixty-three Healthy Districts of England, 1848 *to* 1855.

Years.	Persons.	Males.	Females.
1848	28,679	14,756	13,923
1849	29,128	14,751	14,377
1850	29,699	15,176	14,523
1851	30,163	15,465	14,698
1852	30,370	15,557	14,813
1853	29,214	15,010	14,204

Age.	Males.
	2)29,507=births in 1848 and 1849.
0	14,754=births on January 1, 1849.
1	13,117=living on January 1, 1850.
2	12,664=living on January 1, 1851.
3	12,390=living on January 1, 1852.
4	12,184=living on January 1, 1853.
5	12,047=living on January 1, 1854.

Age.	Males.
0	1,637=deaths in 1849.
1	453=deaths in 1850.
2	274=deaths in 1851.
3	206=deaths in 1852.
4	137=deaths in 1853.

TABLE B.—*The several Values of* λp_x *on which the Life Table of Healthy Districts is based; also the corresponding Values of* p_x *and* $(1-p_x)$.

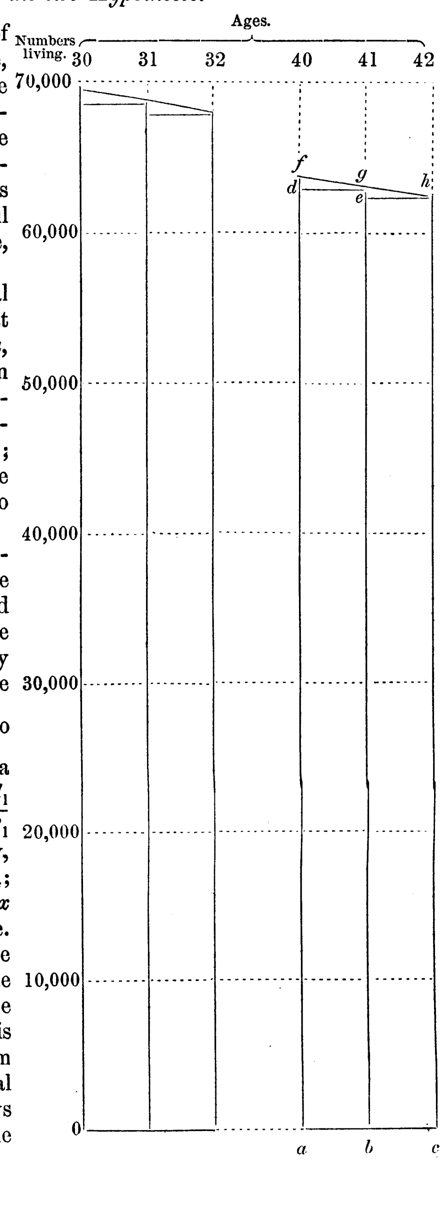
Age x.	λp_x = logarithms of the probability of living one year after the age x.		p_x = probability of *living* a year.		$(1-p_x)$ = probability of *dying* in a year.	
	Males.	Females.	Males.	Females.	Males.	Females.
0	$\bar{1}$·9480215	$\bar{1}$·9577796	·88720	·90736	·11280	·09264
1	$\bar{1}$·9844929	$\bar{1}$·9859276	·96492	·96812	·03508	·03188
2	$\bar{1}$·9904341	$\bar{1}$·9904679	·97821	·97829	·02179	·02171
3	$\bar{1}$·9932422	$\bar{1}$·9932928	·98456	·98467	·01544	·01533
7	$\bar{1}$·9970729	$\bar{1}$·9969512	·99328	·99300	·00672	·00700
12	$\bar{1}$·9984539	$\bar{1}$·9980197	·99645	·99545	·00355	·00455
20	$\bar{1}$·9969724	$\bar{1}$·9966528	·99305	·99232	·00695	·00768
30	$\bar{1}$·9964260	$\bar{1}$·9960967	·99180	·99105	·00820	·00895
40	$\bar{1}$·9959051	$\bar{1}$·9956263	·99062	·98998	·00938	·01002
50	$\bar{1}$·9943048	$\bar{1}$·9946669	·98697	·98780	·01303	·01220
60	$\bar{1}$·9895894	$\bar{1}$·9902049	·97631	·97770	·02369	·02230
70	$\bar{1}$·9751357	$\bar{1}$·9773538	·94436	·94919	·05564	·05081
80	$\bar{1}$·9420680	$\bar{1}$·9463182	·87512	·88373	·12488	·11627
90	$\bar{1}$·8747315	$\bar{1}$·8809176	·74943	·76018	·25057	·23982

Note.—Age x is in this Table the precise age. Age 12 is applied frequently to all persons of the age of 12 and under the age of 13; but in this Table it applies only to persons of the precise age of 12 years, neither more nor less. The λp_7 was, in both cases, derived from the formula $\left(\frac{2-m}{2+m}\right)$. The λp_{12}, deduced from this formula, is for males $\bar{1}$·9983497, and for females $\bar{1}$·9979153, which may be regarded either as the constant or the mean values of λp_{10}, λp_{11}, λp_{12}, λp_{13}, and λp_{14}; but as these are the terminations of an ascending and a descending series, it is probable, and quite in conformity with other observations, that one, two, or more of these

values will exceed the mean value. The logarithms of p_{12} adopted are given above; and the two arithmetical means of the five logarithms, λp_{10}, λp_{11}, λp_{12}, λp_{13}, and λp_{14}, resulting from the interpolation, are $\bar{1}\cdot9983688$ for males, and $\bar{1}\cdot9979435$ for females.

The values of λp_{20}, λp_{30} . . . . . are derived from the formula $y_x = 10^{\frac{k^2 m}{\lambda r}(1-r^x)}$.

Note on the two Hypotheses.



Let b be the decrement of the ordinate y in a unit of time, then the decrement Δy of the ordinate in the time x, represented by the abscissa, will be $\Delta y = -bx$, on Demoivre's hypothesis; and as it is always proportional to the time, it will be, in an infinitely short time, $dy = -bdx$.

Passing to the integral $y = c - bx$; and if $y = a$ at the origin, when $x = 0$, $c = a$, $\therefore y = a - bx$; and if $b = 1$, then $y = a - x$. This evidently represents very closely short portions of the Life Table curve; and the smaller x is taken, the nearer is the approximation to the corresponding value of y.

Again: let Δy be the decrement of the ordinate y in the indefinite time Δx, represented by the abscissa; and let the mortality (m), represented by the ratio of the area $abfg$ to the area dfg, be $\frac{d_0}{P_0} = m_0$; let also m_0 increase at the rate r in a unit of time, so that $\frac{geh}{bcgh} = \frac{d_1}{P_1} = m_1 = m_0 r$, and generally, within given limits, $m_0 r^x = m_x$; then $\Delta y = -y m_x \Delta x$ nearly, Δx being any small portion of time.

The error increases as the time Δx is extended, from the circumstance that on the one hand m_x varies by hypothesis momentarily, and that y, from which the varying proportional part is taken, constantly grows shorter. But by passing to the

limit, and making the time dx infinitely short, m_x and y during that infinitely short time may be considered constant, and $dy=-ym_x dx$ will be the true decrement. Substituting $m_0 r^x$ for m_x, the equation becomes $dy=-ym_0 r^x dx$, from which the value of y can be derived, as before shown; for $\frac{dy}{y}=-m_0 r^x dx$, and, integrating both sides, $\lambda_\epsilon y=\lambda_\epsilon c-\frac{m_0 r^x}{\lambda_\epsilon r}$; here λ_ϵ stands for the logarithm having ϵ for its base.

At the origin of the curve, when $x=0$, let $y=1$, and then $\lambda_\epsilon c=\frac{m_0}{\lambda_\epsilon r}$. Now, substituting this value for $\lambda_\epsilon c$, we have $\lambda_\epsilon y=\frac{m_0}{\lambda_\epsilon r}-\frac{m_0 r^x}{\lambda_\epsilon r}$,

$\therefore \lambda_\epsilon y=\frac{m_0}{\lambda_\epsilon r}(1-r^x)$; and, passing to the number, $y=\epsilon^{\frac{m_0}{\lambda_\epsilon r}(1-r^x)}$. Putting k for the modulus of the common logarithm (λ) having 10 for its base, we have $\lambda_\epsilon y=\frac{\lambda y}{k}$, and $\lambda_\epsilon r=\frac{\lambda r}{k}$, $\therefore \frac{\lambda y}{k}=\frac{km}{\lambda r}(1-r^x)$; or, passing to the number, $y=10^{\frac{k^2 m}{\lambda r}(1-r^x)}$

Upon the one hypothesis, out of a generation of men an *equal quantity of life** is destroyed in equal times, out of diminishing quantities in existence, the *proportion* that perishes of the residual life constantly *increasing*.

Upon the other hypothesis, a *decreasing proportion* of the residual life is destroyed from birth down to the age of puberty; in the after ages, a *proportion increasing* at different rates is destroyed in equal times. The *quantity* of life *destroyed* in equal times may be the same, or different upon this hypothesis; and in very short intervals of age the differences between *the quantities of life destroyed* may be so inconsiderable that they may be neglected.

The two hypotheses may be illustrated. Assume that at every beat of the heart an equal quantity of vital force on an average is consumed in excess of that produced; or if this does not happen at distant ages, assume that it happens during two consecutive years, two consecutive days, two consecutive pulses of a generation of men, and is represented by the deaths in the two intervals. This will give an idea of the first hypothesis.

The second hypothesis will be represented by assuming that, in addition to the existing force, a certain amount of vital force is produced, while a certain amount is also destroyed at every beat of the heart—the quantity destroyed exceeding the quantity produced in a diminishing ratio, and then in an increasing ratio—the proportional part destroyed being for this purpose always represented by the proportional number of hearts beating to the number of hearts ceasing to beat at every instant of age among a generation of men. The respirations, the sensations, the secretions, nutrition, and all the vital acts, may be conceived, like the heart, to influence the continuance of the vital force, implying here simply the force which sustains life.

* The quality or the intensity of life at different ages is purposely left out of consideration.

TABLE B 1.—*Life Table of Healthy English Districts.—Logarithms of the Numbers of Males and Females living at each Year of Age.*

λl_x.				λl_x.			
Age. x.	Males.	Age x.	Females.	Age x.	Males.	Age x.	Females.
0	4·7086364	0	4·6890835	55	4·4351998	55	4·4177773
1	4·6566579	1	4·6468631	56	4·4279544	56	4·4116015
2	4·6411508	2	4·6327907	57	4·4203212	57	4·4052190
3	4·6315849	3	4·6232586	58	4·4122719	58	4·3981522
4	4·6248271	4	4·6165514	59	4·4037768	59	4·3901691
5	4·6193109	5	4·6110606	60	4·3943905	60	4·3812819
6	4·6148376	6	4·6065737	61	4·3839799	61	4·3714868
7	4·6112225	7	4·6028950	62	4·3725154	62	4·3607637
8	4·6082954	8	4·5998462	63	4·3599518	63	4·3490765
9	4·6059001	9	4·5972658	64	4·3462281	64	4·3363727
10	4·6038946	10	4·5950094	65	4·3312678	65	4·3225837
11	4·6021511	11	4·5929497	66	4·3149786	66	4·3076249
12	4·6005560	12	4·5909763	67	4·2972528	67	4·2913951
13	4·5990100	13	4·5889960	68	4·2779668	68	4·2737774
14	4·5974279	14	4·5869326	69	4·2569814	69	4·2546384
15	4·5957387	15	4·5847269	70	4·2341418	70	4·2338287
16	4·5938855	16	4·5823368	71	4·2092775	71	4·2111825
17	4·5918259	17	4·5797373	72	4·1822024	72	4·1865180
18	4·5895314	18	4·5769202	73	4·1527146	73	4·1596372
19	4·5869878	19	4·5738947	74	4·1205968	74	4·1303259
20	4·5841951	20	4·5706868	75	4·0856157	75	4·0983537
21	4·5811675	21	4·5673396	76	4·0475228	76	4·0634741
22	4·5780527	22	4·5639166	77	4·0060534	77	4·0254242
23	4·5748607	23	4·5604237	78	3·9609277	78	3·9839252
24	4·5716008	24	4·5568665	79	3·9118498	79	3·9386819
25	4·5682808	25	4·5532498	80	3·8585083	80	3·8893831
26	4·5649078	26	4·5495779	81	3·8005763	81	3·8357013
27	4·5614874	27	4·5458546	82	3·7377111	82	3·7772929
28	4·5580244	28	4·5420830	83	3·6695542	83	3·7137979
29	4·5545223	29	4·5382656	84	3·5957318	84	3·6448405
30	4·5509835	30	4·5344046	85	3·5158541	85	3·5700284
31	4·5474095	31	4·5305013	86	3·4295159	86	3·4889532
32	4·5438005	32	4·5265566	87	3·3362962	87	3·4011904
33	4·5401557	33	4·5225708	88	3·2357583	88	3·3062992
34	4·5364730	34	4·5185435	89	3·1274500	89	3·2038228
35	4·5327494	35	4·5144739	90	3·0109034	90	3·0932880
36	4·5289808	36	4·5103606	91	2·8856349	91	2·9742056
37	4·5251620	37	4·5062016	92	2·7511453	92	2·8460701
38	4·5212864	38	4·5019942	93	2·6069196	93	2·7083599
39	4·5173467	39	4·4977353	94	2·4524273	94	2·5605372
40	4·5133342	40	4·4934212	95	2·2871223	95	2·4020479
41	4·5092393	41	4·4890475	96	2·1104426	96	2·2323219
42	4·5050512	42	4·4846093	97	1·9218108	97	2·0507729
43	4·5007579	43	4·4801012	98	1·7206337	98	1·8567982
44	4·4963465	44	4·4755172	99	1·5063024	99	1·6497793
45	4·4918029	45	4·4708506	100	1·2781926	100	1·4290811
46	4·4871119	46	4·4660943	101	1·0356640	101	1·1940526
47	4·4822570	47	4·4612404	102	0·7780608	102	0·9440265
48	4·4772210	48	4·4562807	103	0·5047118	103	0·6783194
49	4·4719852	49	4·4512061	104	0·2149296	104	0·3962318
50	4·4665301	50	4·4460074	105	9·9080117	105	0·0970476
51	4·4608349	51	4·4406743	106	9·5832396	106	9·7800351
52	4·4548778	52	4·4351962	107	9·2398792	107	9·4444460
53	4·4486358	53	4·4295620	108	8·8771808	108	9·0895160
54	4·4420848	54	4·4237598	109	8·4943792	109	8·7144646

TABLE C.—*Healthy Districts.*

Age.	Living at each Age (l_x).			Dying in each Year of Age (d_x).			Age.
x.	Persons.	Males.	Females.	Persons.	Males.	Females.	x.
0	100,000	51,125	48,875	10,295	5,767	4,528	0
1	89,705	45,358	44,347	3,005	1,591	1,414	1
2	86,700	43,767	42,933	1,885	953	932	2
3	84,815	42,814	42,001	1,305	661	644	3
4	83,510	42,153	41,357	1,051	532	519	4
5	82,459	41,621	40,838	847	427	420	5
6	81,612	41,194	40,418	682	341	341	6
7	80,930	40,853	40,077	555	275	280	7
8	80,375	40,578	39,797	459	223	236	8
9	79,916	40,355	39,561	391	186	205	9
10	79,525	40,169	39,356	347	161	186	10
11	79,178	40,008	39,170	324	146	178	11
12	78,854	39,862	38,992	319	142	177	12
13	78,535	39,720	38,815	328	144	184	13
14	78,207	39,576	38,631	350	154	196	14
15	77,857	39,422	38,435	379	168	211	15
16	77,478	39,254	38,224	414	186	228	16
17	77,064	36,068	37,996	451	205	246	17
18	76,613	38,863	37,750	489	227	262	18
19	76,124	38,636	37,488	524	248	276	19
20	75,600	38,388	37,212	552	267	285	20
21	75,048	38,121	36,927	562	272	290	21
22	74,486	37,849	36,637	571	277	294	22
23	73,915	37,572	36,343	577	281	296	23
24	73,338	37,291	36,047	583	284	299	24
25	72,755	37,007	35,748	588	287	301	25
26	72,167	36,720	35,447	591	288	303	26
27	71,576	36,432	35,144	593	289	304	27
28	70,983	36,143	34,840	595	290	305	28
29	70,388	35,853	34,535	596	291	305	29
30	69,792	35,562	34,230	598	292	306	30
31	69,194	35,270	33,924	599	292	307	31
32	68,595	34,978	33,617	599	292	307	32
33	67,996	34,686	33,310	601	293	308	33
34	67,395	34,393	33,002	601	293	308	34
35	66,794	34,100	32,694	603	295	308	35
36	66,191	33,805	32,386	604	296	308	36
37	65,587	33,509	32,078	608	298	310	37
38	64,979	33,211	31,768	610	300	310	38
39	64,369	32,911	31,458	613	302	311	39
40	63,756	32,609	31,147	618	306	312	40
41	63,138	32,303	30,835	623	310	313	41
42	62,515	31,993	30,522	630	315	315	42
43	61,885	31,678	30,207	638	320	318	43
44	61,247	31,358	29,889	645	326	319	44
45	60,602	31,032	29,570	656	334	322	45
46	59,946	30,698	29,248	666	341	325	46
47	59,280	30,357	28,923	679	350	329	47
48	58,601	30,007	28,594	692	360	332	48
49	57,909	29,647	28,262	706	370	336	49
50	57,203	29,277	27,926	722	381	341	50
51	56,481	28,896	27,585	740	394	346	51
52	55,741	28,502	27,239	758	407	351	52
53	54,983	28,095	26,888	777	420	357	53

TABLE C (*continued*).

Age.	LIVING AT EACH AGE (l_x).			DYING IN EACH YEAR OF AGE (d_x).			Age.
x.	Persons.	Males.	Females.	Persons.	Males.	Females.	x.
54	54,206	27,675	26,531	798	435	363	54
55	53,408	27,240	26,168	820	451	369	55
56	52,588	26,789	25,799	843	467	376	56
57	51,745	26,322	25,423	894	483	411	57
58	50,851	25,839	25,012	956	501	455	58
59	49,895	25,338	24,557	1,040	542	498	59
60	48,855	24,796	24,059	1,123	587	536	60
61	47,732	24,209	23,523	1,205	631	574	61
62	46,527	23,578	22,949	1,281	672	609	62
63	45,246	22,906	22,340	1,356	712	644	63
64	43,890	22,194	21,696	1,430	752	678	64
65	42,460	21,442	21,018	1,501	789	712	65
66	40,959	20,653	20,306	1,571	826	745	66
67	39,388	19,827	19,561	1,638	861	777	67
68	37,750	18,966	18,784	1,705	895	810	68
69	36,045	18,071	17,974	1,767	926	841	69
70	34,278	17,145	17,133	1,825	954	871	70
71	32,453	16,191	16,262	1,876	978	898	71
72	30,577	15,213	15,364	1,921	999	922	72
73	28,656	14,214	14,442	1,955	1,013	942	73
74	26,701	13,201	13,500	1,980	1,022	958	74
75	24,721	12,179	12,542	1,991	1,023	968	75
76	22,730	11,156	11,574	1,987	1,016	971	76
77	20,743	10,140	10,603	1,966	1,000	966	77
78	18,777	9,140	9,637	1,931	977	954	78
79	16,846	8,163	8,683	1,875	943	932	79
80	14,971	7,220	7,751	1,803	902	901	80
81	13,168	6,318	6,850	1,713	851	862	81
82	11,455	5,467	5,988	1,608	794	814	82
83	9,847	4,673	5,174	1,491	731	760	83
84	8,356	3,942	4,414	1,360	662	698	84
85	6,996	3,280	3,716	1,224	591	633	85
86	5,772	2,689	3,083	1,084	520	564	86
87	4,688	2,169	2,519	943	448	495	87
88	3,745	1,721	2,024	805	380	425	88
89	2,940	1,341	1,599	675	316	359	89
90	2,265	1,025	1,240	555	257	298	90
91	1,710	768	942	444	204	240	91
92	1,266	564	702	350	159	191	92
93	916	405	511	269	122	147	93
94	647	283	364	201	89	112	94
95	446	194	252	146	65	81	95
96	300	129	171	104	45	59	96
97	196	84	112	71	31	40	97
98	125	53	72	48	21	27	98
99	77	32	45	31	13	18	99
100	46	19	27	19	8	11	100
101	27	11	16	12	5	7	101
102	15	6	9	7	3	4	102
103	8	3	5	4	1	3	103
104	4	2	2	2	1	1	104
105	2	1	1	1	1	..	105
106	1	..	1	1	..	1	106

TABLE D.—*Healthy Districts.—Persons.*

Age.	Dying in each Year of Age, 0–1, 1–2, to 105–106.	Born and Living at each Age.	Sum of the Numbers Born and Living at each Age (x) from x to the last Age in the Table.	Population, or the living in each Year of Age 0 to 1, 1 to 2, &c.	(1) Sum of the Living, and of the Living of every Age (x) and upwards to the last Age in the Table; also (2) the Years which the Persons (l_x) will live.	(1) The Years which the Persons at the Age (x) and upwards will live; also (2) the Years which they have lived over x.	Age.
		Σd_x.	Σl_x.	$\frac{1}{2}(l_x+l_{x+1}) = l_{x+1}+\frac{1}{2}d_x$.	ΣP_x.	$\Sigma\frac{1}{2}(Q_x+Q_{x+1}) = Y_{x+1}+(Q_{x+1}+\frac{1}{2}P_x)$.	
x.	d_x.	l_x.	L_x.	P_x.	Q_x.	Y_x.	x.
0	10,295	100,000	4,951,908	92,611	4,899,665	166,209,701	0
1	3,005	89,705	4,851,908	88,202	4,807,054	161,356,341	1
2	1,885	86,700	4,762,203	85,758	4,718,852	156,593,388	2
3	1,305	84,815	4,675,503	84,162	4,633,094	151,917,415	3
4	1,051	83,510	4,590,688	82,985	4,548,932	147,326,402	4
5	847	82,459	4,507,178	82,036	4,465,947	142,818,963	5
6	682	81,612	4,424,719	81,270	4,383,911	138,394,034	6
7	555	80,930	4,343,107	80,653	4,302,641	134,050,757	7
8	459	80,375	4,262,177	80,145	4,221,988	129,788,443	8
9	391	79,916	4,181,802	79,721	4,141,843	125,606,527	9
10	347	79,525	4,101,886	79,352	4,062,122	121,504,545	10
11	324	79,178	4,022,361	79,016	3,982,770	117,482,099	11
12	319	78,854	3,943,183	78,694	3,903,754	113,538,837	12
13	328	78,535	3,864,329	78,371	3,825,060	109,674,430	13
14	350	78,207	3,785,794	78,032	3,746,689	105,888,556	14
15	379	77,857	3,707,587	77,668	3,668,657	102,180,882	15
16	414	77,478	3,629,730	77,271	3,590,989	98,551,059	16
17	451	77,064	3,552,252	76,838	3,513,718	94,998,706	17
18	489	76,613	3,475,188	76,369	3,436,880	91,523,407	18
19	524	76,124	3,398,575	75,862	3,360,511	88,124,711	19
20	552	75,600	3,322,451	75,323	3,284,649	84,802,131	20
21	562	75,048	3,246,851	74,767	3,209,326	81,555,144	21
22	571	74,486	3,171,803	74,201	3,134,559	78,383,202	22
23	577	73,915	3,097,317	73,626	3,060,358	75,285,743	23
24	583	73,338	3,023,402	73,047	2,986,732	72,262,198	24
25	588	72,755	2,950,064	72,461	2,913,685	69,311,989	25
26	591	72,167	2,877,309	71,872	2,841,224	66,434,535	26
27	593	71,576	2,805,142	71,279	2,769,352	63,629,247	27
28	595	70,983	2,733,566	70,685	2,698,073	60,895,535	28
29	596	70,388	2,662,583	70,091	2,627,388	58,232,804	29
30	598	69,792	2,592,195	69,493	2,557,297	55,640,462	30
31	599	69,194	2,522,403	68,894	2,487,804	53,117,911	31
32	599	68,595	2,453,209	68,296	2,418,910	50,664,554	32
33	601	67,996	2,384,614	67,695	2,350,614	48,279,792	33
34	601	67,395	2,316,618	67,095	2,282,919	45,963,025	34
35	603	66,794	2,249,223	66,492	2,215,824	43,713,654	35
36	604	66,191	2,182,429	65,889	2,149,332	41,531,076	36
37	608	65,587	2,116,238	65,283	2,083,443	39,414,688	37
38	610	64,979	2,050,651	64,674	2,018,160	37,363,887	38
39	613	64,369	1,985,672	64,062	1,953,486	35,378,064	39
40	618	63,756	1,921,303	63,447	1,889,424	33,456,609	40
41	623	63,138	1,857,547	62,827	1,825,977	31,598,909	41
42	630	62,515	1,794,409	62,200	1,763,150	29,804,345	42
43	638	61,885	1,731,894	61,566	1,700,950	28,072,295	43
44	645	61,247	1,670,009	60,925	1,639,384	26,402,128	44
45	656	60,602	1,608,762	60,274	1,578,459	24,793,206	45
46	666	59,946	1,548,160	59,612	1,518,185	23,244,885	46
47	679	59,280	1,488,214	58,941	1,458,573	21,756,505	47
48	692	58,601	1,428,934	58,255	1,399,632	20,327,403	48
49	706	57,909	1,370,333	57,556	1,341,377	18,956,899	49
50	722	57,203	1,312,424	56,842	1,283,821	17,644,300	50
51	740	56,481	1,255,221	56,111	1,226,979	16,388,899	51
52	758	55,741	1,198,740	55,362	1,170,868	15,189,976	52
53	777	54,983	1,142,999	54,594	1,115,506	14,046,789	53

TABLE D (*continued*).

Age.	Dying in each Year of Age, 0–1, 1–2, to 105–106.	Born and Living at each Age.	Sum of the Numbers Born and Living at each Age (x) from x to the last Age in the Table.	Population, or the Living in each Year of Age 0 to 1, 1 to 2, &c.	(1) Sum of the Living, and of the Living of every Age (x) and upwards to the last Age in the Table; also (2) the Years which the Persons (l_x) will live.	(1) The Years which the Persons at the Age (x) and upwards will live; also (2) the Years which they have lived over x.	Age.
		Σd_x.	Σl_x.	$\frac{1}{2}(l_x + l_{x+1}) = l_{x+1} + \frac{1}{2}d_x$.	$\Sigma \mathrm{P}_x$.	$\Sigma\frac{1}{2}(\mathrm{Q}_x + \mathrm{Q}_{x+1}) = \mathrm{Y}_{x+1} + (\mathrm{Q}_{x+1} + \frac{1}{2}\mathrm{P}_x)$.	
x.	d_x.	l_x.	L_x.	P_x.	Q_x.	Y_x.	x.
54	798	54,206	1,088,016	53,808	1,060,912	12,958,580	54
55	820	53,408	1,033,810	52,997	1,007,104	11,924,572	55
56	843	52,588	980,402	52,167	954,107	10,943,966	56
57	894	51,745	927,814	51,298	901,940	10,015,943	57
58	956	50,851	876,069	50,373	850,642	9,139,652	58
59	1,040	49,895	825,218	49,375	800,269	8,314,197	59
60	1,123	48,855	775,323	48,293	750,894	7,538,615	60
61	1,205	47,732	726,468	47,130	702,601	6,811,867	61
62	1,281	46,527	678,736	45,887	655,471	6,132,831	62
63	1,356	45,246	632,209	44,568	609,584	5,500,304	63
64	1,430	43,890	586,963	43,175	565,016	4,913,004	64
65	1,501	42,460	543,073	41,709	521,841	4,369,575	65
66	1,571	40,959	500,613	40,173	480,132	3,868,589	66
67	1,638	39,388	459,654	38,570	439,959	3,408,544	67
68	1,705	37,750	420,266	36,897	401,389	2,987,869	68
69	1,767	36,045	382,516	35,161	364,492	2,604,929	69
70	1,825	34,278	346,471	33,366	329,331	2,258,017	70
71	1,876	32,453	312,193	31,515	295,965	1,945,369	71
72	1,921	30,577	279,740	29,617	264,450	1,665,162	72
73	1,955	28,656	249,163	27,678	234,833	1,415,520	73
74	1,980	26,701	220,507	25,711	207,155	1,194,527	74
75	1,991	24,721	193,806	23,726	181,444	1,000,227	75
76	1,987	22,730	169,085	21,736	157,718	830,646	76
77	1,966	20,743	146,355	19,760	135,982	683,796	77
78	1,931	18,777	125,612	17,811	116,222	557,694	78
79	1,875	16,846	106,835	15,909	98,411	450,377	79
80	1,803	14,971	89,989	14,070	82,502	359,921	80
81	1,713	13,168	75,018	12,311	68,432	284,454	81
82	1,608	11,455	61,850	10,651	56,121	222,178	82
83	1,491	9,847	50,395	9,102	45,470	171,382	83
84	1,360	8,356	40,548	7,676	36,368	130,463	84
85	1,224	6,996	32,192	6,383	28,692	97,933	85
86	1,084	5,772	25,196	5,230	22,309	72,432	86
87	943	4,688	19,424	4,217	17,079	52,739	87
88	805	3,745	14,736	3,342	12,862	37,768	88
89	675	2,940	10,991	2,603	9,520	26,577	89
90	555	2,265	8,051	1,988	6,917	18,358	90
91	444	1,710	5,786	1,488	4,929	12,436	91
92	350	1,266	4,076	1,090	3,441	8,251	92
93	269	916	2,810	782	2,351	5,355	93
94	201	647	1,894	547	1,569	3,395	94
95	146	446	1,247	372	1,022	2,099	95
96	104	300	801	249	650	1,263	96
97	71	196	501	160	401	737	97
98	48	125	305	101	241	416	98
99	31	77	180	61	140	226	99
100	19	46	103	37	79	116	100
101	12	27	57	21	42	56	101
102	7	15	30	11	21	24	102
103	4	8	15	7	10	9	103
104	2	4	7	2	3	3	104
105	1	2	3	1	1	..	105
106	1	1	1	..	..	..	106

TABLE E.—*Healthy Districts.—Males.*

Age.	Dying in each Year of Age 0–1, 1–2, to 104–105.	Born and Living at each Age.	Sum of the Numbers Born and Living at each Age (x) from x to the last Age in the Table.	Population, or the Living in each Year of Age 0 to 1, 1 to 2, &c.	(1) Sum of the Living, and of the Living of every Age (x) and upwards to the last Age in the Table; also (2) the Years which the Males (l_x) will live.	(1) The Years which the Males at the Age (x) and upwards will live; also (2) the Years which they have lived over x.	Age.
		Σd_x.	Σl_x.	$\frac{1}{2}(l_x+l_{x+1}) = l_{x+1}+\frac{1}{2}d_x$.	ΣP_x.	$\Sigma\frac{1}{2}(Q_x+Q_{x+1}) = Y_{x+1}+(Q_{x+1}+\frac{1}{2}P_x)$.	
x.	d_x.	l_x.	L_x.	P_x.	Q_x.	Y_x.	x.
0	5,767	51,125	2,509,635	46,915*	2,482,745	84,008,921	0
1	1,591	45,358	2,458,510	44,562	2,435,830	81,549,633	1
2	953	43,767	2,413,152	43,291	2,391,268	79,136,084	2
3	661	42,814	2,369,385	42,483	2,347,977	76,766,462	3
4	532	42,153	2,326,571	41,887	2,305,494	74,439,726	4
5	427	41,621	2,284,418	41,408	2,263,607	72,155,176	5
6	341	41,194	2,242,797	41,023	2,222,199	69,912,273	6
7	275	40,853	2,201,603	40,716	2,181,176	67,710,585	7
8	223	40,578	2,160,750	40,466	2,140,460	65,549,767	8
9	186	40,355	2,120,172	40,262	2,099,994	63,429,540	9
10	161	40,169	2,079,817	40,089	2,059,732	61,349,677	10
11	146	40,008	2,039,648	39,935	2,019,643	59,309,990	11
12	142	39,862	1,999,640	39,791	1,979,708	57,310,314	12
13	144	39,720	1,959,778	39,648	1,939,917	55,350,502	13
14	154	39,576	1,920,058	39,499	1,900,269	53,430,409	14
15	168	39,422	1,880,482	39,338	1,860,770	51,549,889	15
16	186	39,254	1,841,060	39,161	1,821,432	49,708,788	16
17	205	39,068	1,801,806	38,965	1,782,271	47,906,937	17
18	227	38,863	1,762,738	38,750	1,743,306	46,144,148	18
19	248	38,636	1,723,875	38,512	1,704,556	44,420,217	19
20	267	38,388	1,685,239	38,254	1,666,044	42,734,917	20
21	272	38,121	1,646,851	37,985	1,627,790	41,088,000	21
22	277	37,849	1,608,730	37,711	1,589,805	39,479,203	22
23	281	37,572	1,570,881	37,431	1,552,094	37,908,253	23
24	284	37,291	1,533,309	37,149	1,514,663	36,374,875	24
25	287	37,007	1,496,018	36,864	1,477,514	34,878,786	25
26	288	36,720	1,459,011	36,576	1,440,650	33,419,704	26
27	289	36,432	1,422,291	36,287	1,404,074	31,997,342	27
28	290	36,143	1,385,859	35,998	1,367,787	30,611,412	28
29	291	35,853	1,349,716	35,708	1,331,789	29,261,624	29
30	292	35,562	1,313,863	35,416	1,296,081	27,947,689	30
31	292	35,270	1,278,301	35,124	1,260,665	26,669,316	31
32	292	34,978	1,243,031	34,832	1,225,541	25,426,213	32
33	293	34,686	1,208,053	34,539	1,190,709	24,218,088	33
34	293	34,393	1,173,367	34,247	1,156,170	23,044,648	34
35	295	34,100	1,138,974	33,952	1,121,923	21,905,602	35
36	296	33,805	1,104,874	33,657	1,087,971	20,800,655	36
37	298	33,509	1,071,069	33,360	1,054,314	19,729,512	37
38	300	33,211	1,037,560	33,061	1,020,954	18,691,878	38
39	302	32,911	1,004,349	32,760	987,893	17,687,455	39
40	306	32,609	971,438	32,456	955,133	16,715,942	40
41	310	32,303	938,829	32,148	922,677	15,777,037	41
42	315	31,993	906,526	31,836	890,529	14,870,434	42
43	320	31,678	874,533	31,518	858,693	13,995,823	43
44	326	31,358	842,855	31,195	827,175	13,152,889	44
45	334	31,032	811,497	30,865	795,980	12,341,311	45
46	341	30,698	780,465	30,527	765,115	11,560,764	46
47	350	30,357	749,767	30,182	734,588	10,810,912	47
48	360	30,007	719,410	29,827	704,406	10,091,415	48
49	370	29,647	689,403	29,462	674,579	9,401,923	49
50	381	29,277	659,756	29,087	645,117	8,742,075	50
51	394	28,896	630,479	28,699	616,030	8,111,501	51

* P_0 is $\frac{1}{2}(l_0+l_1)\times(\cdot 9725)$. The factor ·9725 has been introduced, as the number living in the first year is less than the arithmetical mean of those born and surviving a year.

TABLE E (*continued*).

Age.	Dying in each Year of Age 0–1, 1–2, to 104–105.	Born and Living at each Age.	Sum of the Numbers Born and Living at each Age (x) from x to the last Age in the Table.	Population, or the Living in each Year of Age 0 to 1, 1 to 2, &c.	(1) Sum of the Living, and of the Living of every Age (x) and upwards to the last Age in the Table; also (2) the Years which the Males (l_x) will live.	(1) The Years which the Males at the Age x and upwards will live; also (2) the Years which they have lived over x.	Age.
		Σd_x.	Σl_x.	$\frac{1}{2}(l_x + l_{x+1}) = l_{x+1} + \frac{1}{2}d_x$.	ΣP_x.	$\Sigma\frac{1}{2}(Q_x + Q_{x+1}) = Y_{x+1} + (Q_{x+1} + \frac{1}{2}P_x)$.	
x.	d_x.	l_x.	L_x.	P_x.	Q_x.	Y_x.	x.
52	407	28,502	601,583	28,298	587,331	7,509,821	52
53	420	28,095	573,081	27,885	559,033	6,936,639	53
54	435	27,675	544,986	27,458	531,148	6,391,548	54
55	451	27,240	517,311	27,014	503,690	5,874,129	55
56	467	26,789	490,071	26,556	476,676	5,383,946	56
57	483	26,322	463,282	26,080	450,120	4,920,548	57
58	501	25,839	436,960	25,589	424,040	4,483,468	58
59	542	25,338	411,121	25,067	398,451	4,072,223	59
60	587	24,796	385,783	24,502	373,384	3,686,305	60
61	631	24,209	360,987	23,894	348,882	3,325,172	61
62	672	23,578	336,778	23,242	324,988	2,988,237	62
63	712	22,906	313,200	22,550	301,746	2,674,870	63
64	752	22,194	290,294	21,818	279,196	2,384,399	64
65	789	21,442	268,100	21,047	257,378	2,116,112	65
66	826	20,653	246,658	20,240	236,331	1,869,258	66
67	861	19,827	226,005	19,397	216,091	1,643,047	67
68	895	18,966	206,178	18,518	196,694	1,436,654	68
69	926	18,071	187,212	17,608	178,176	1,249,219	69
70	954	17,145	169,141	16,668	160,568	1,079,847	70
71	978	16,191	151,996	15,702	143,900	927,613	71
72	999	15,213	135,805	14,714	128,198	791,564	72
73	1,013	14,214	120,592	13,707	113,484	670,723	73
74	1,022	13,201	106,378	12,690	99,777	564,093	74
75	1,023	12,179	93,177	11,668	87,087	470,661	75
76	1,016	11,156	80,998	10,648	75,419	389,408	76
77	1,000	10,140	69,842	9,640	64,771	319,313	77
78	977	9,140	59,702	8,651	55,131	259,362	78
79	943	8,163	50,562	7,692	46,480	208,556	79
80	902	7,220	42,399	6,769	38,788	165,922	80
81	851	6,318	35,179	5,892	32,019	130,519	81
82	794	5,467	28,861	5,070	26,127	101,446	82
83	731	4,673	23,394	4,308	21,057	77,854	83
84	662	3,942	18,721	3,611	16,749	58,951	84
85	591	3,280	14,779	2,984	13,138	44,007	85
86	520	2,689	11,499	2,429	10,154	32,361	86
87	448	2,169	8,810	1,945	7,725	23,422	87
88	380	1,721	6,641	1,531	5,780	16,669	88
89	316	1,341	4,920	1,183	4,249	11,655	89
90	257	1,025	3,579	897	3,066	7,997	90
91	204	768	2,554	666	2,169	5,380	91
92	159	564	1,786	484	1,503	3,544	92
93	122	405	1,222	344	1,019	2,283	93
94	89	283	817	239	675	1,436	94
95	65	194	534	161	436	880	95
96	45	129	340	107	275	525	96
97	31	84	211	68	168	303	97
98	21	53	127	43	100	169	98
99	13	32	74	25	57	91	99
100	8	19	42	15	32	46	100
101	5	11	23	9	17	22	101
102	3	6	12	4	8	9	102
103	1	3	6	3	4	3	103
104	1	2	3	1	1	1	104
105	1	1	1	..	..	..	105
106	..	..	..	..	..	..	106

TABLE F.—*Healthy Districts.—Females.*

Age.	Dying in each Year of Age 0–1, 1–2, to 105–106.	Born and Living at each Age.	Sum of the Numbers Born and Living at each Age (x) from x to the last Age in the Table.	Population, or the Living in each Year of Age 0 to 1, 1 to 2, &c.	(1) Sum of the Living, and of the Living of every Age (x) and upwards to the last Age in the Table; also (2) the Years which the Females (l_x) will live.	(1) The Years which the Females at the Age (x) and upwards will live; also (2) the Years which they have lived over x.	Age.
		Σd_x.	Σl_x.	$\frac{1}{2}(l_x + l_{x+1}) = l_{x+1} + \frac{1}{2}d_x$.	ΣP_x.	$\Sigma\frac{1}{2}(Q_x + Q_{x+1}) = Y_{x+1} + (Q_{x+1} + \frac{1}{2}P_x)$.	
x.	d_x.	l_x.	L_x.	P_x.	Q_x.	Y_x.	x.
0	4,528	48,875	2,442,273	45,696*	2,416,920	82,200,780	0
1	1,414	44,347	2,393,398	43,640	2,371,224	79,806,708	1
2	932	42,933	2,349,051	42,467	2,327,584	77,457,304	2
3	644	42,001	2,306,118	41,679	2,285,117	75,150,953	3
4	519	41,357	2,264,117	41,098	2,243,438	72,886,676	4
5	420	40,838	2,222,760	40,628	2,202,340	70,663,787	5
6	341	40,418	2,181,922	40,247	2,161,712	68,481,761	6
7	280	40,077	2,141,504	39,937	2,121,465	66,340,172	7
8	236	39,797	2,101,427	39,679	2,081,528	64,238,676	8
9	205	39,561	2,061,630	39,459	2,041,849	62,176,987	9
10	186	39,356	2,022,069	39,263	2,002,390	60,154,868	10
11	178	39,170	1,982,713	39,081	1,963,127	58,172,109	11
12	177	38,992	1,943,543	38,903	1,924,046	56,228,523	12
13	184	38,815	1,904,551	38,723	1,885,143	54,323,928	13
14	196	38,631	1,865,736	38,533	1,846,420	52,458,147	14
15	211	38,435	1,827,105	38,330	1,807,887	50,630,993	15
16	228	38,224	1,788,670	38,110	1,769,557	48,842,271	16
17	246	37,996	1,750,446	37,873	1,731,447	47,091,769	17
18	262	37,750	1,712,450	37,619	1,693,574	45,379,259	18
19	276	37,488	1,674,700	37,350	1,655,955	43,704,494	19
20	285	37,212	1,637,212	37,069	1,618,605	42,067,214	20
21	290	36,927	1,600,000	36,782	1,581,536	40,467,144	21
22	294	36,637	1,563,073	36,490	1,544,754	38,903,999	22
23	296	36,343	1,526,436	36,195	1,508,264	37,377,490	23
24	299	36,047	1,490,093	35,898	1,472,069	35,887,323	24
25	301	35,748	1,454,046	35,597	1,436,171	34,433,203	25
26	303	35,447	1,418,298	35,296	1,400,574	33,014,831	26
27	304	35,144	1,382,851	34,992	1,365,278	31,631,905	27
28	305	34,840	1,347,707	34,687	1,330,286	30,284,123	28
29	305	34,535	1,312,867	34,383	1,295,599	28,971,180	29
30	306	34,230	1,278,332	34,077	1,261,216	27,692,773	30
31	307	33,924	1,244,102	33,770	1,227,139	26,448,595	31
32	307	33,617	1,210,178	33,464	1,193,369	25,238,341	32
33	308	33,310	1,176,561	33,156	1,159,905	24,061,704	33
34	308	33,002	1,143,251	32,848	1,126,749	22,918,377	34
35	308	32,694	1,110,249	32,540	1,093,901	21,808,052	35
36	308	32,386	1,077,555	32,232	1,061,361	20,730,421	36
37	310	32,078	1,045,169	31,923	1,029,129	19,685,176	37
38	310	31,768	1,013,091	31,613	997,206	18,672,009	38
39	311	31,458	981,323	31,302	965,593	17,690,609	39
40	312	31,147	949,865	30,991	934,291	16,740,667	40
41	313	30,835	918,718	30,679	903,300	15,821,872	41
42	315	30,522	887,883	30,364	872,621	14,933,911	42
43	318	30,207	857,361	30,048	842,257	14,076,472	43
44	319	29,889	827,154	29,730	812,209	13,249,239	44
45	322	29,570	797,265	29,409	782,479	12,451,895	45
46	325	29,248	767,695	29,085	753,070	11,684,121	46
47	329	28,923	738,447	28,759	723,985	10,945,593	47
48	332	28,594	709,524	28,428	695,226	10,235,988	48
49	336	28,262	680,930	28,094	666,798	9,554,976	49
50	341	27,926	652,668	27,755	638,704	8,902,225	50
51	346	27,585	624,742	27,412	610,949	8,277,398	51
52	351	27,239	597,157	27,064	583,537	7,680,155	52
53	357	26,888	569,918	26,709	556,473	7,110,150	53

* P_0 is $\frac{1}{2}(l_0+l_1) \times (\cdot 98037)$. The factor ·98037 has been introduced, as the number living in the first year is less than the arithmetical mean of those born and surviving a year.

TABLE F (*continued*).

Age.	Dying in each Year of Age, 0–1, 1–2, to 105–106.	Born and Living at each Age.	Sum of the Numbers Born and Living at each Age (x) from x to the last Age in the Table.	Population, or the Living in each Year of Age 0 to 1, 1 to 2, &c.	(1) Sum of the Living, and of the Living of every Age (x) and upwards to the last Age in the Table; also (2) the Years which the Females (l_x) will live.	(1) The Years which the Females at the Age (x) and upwards will live; also (2) the Years which they have lived over x.	Age.
·		Σd_x.	Σl_x.	$\frac{1}{2}(l_x + l_{x+1}) = l_{x+1} + \frac{1}{2}d_x$.	ΣP_x.	$\Sigma\frac{1}{2}(Q_x + Q_{x+1}) = Y_{x+1} + (Q_{x+1} + \frac{1}{2}P_x)$.	
x.	d_x.	l_x.	L_x.	P_x.	Q_x.	Y_x.	x.
54	363	26,531	543,030	26,350	529,764	6,567,032	54
55	369	26,168	516,499	25,983	503,414	6,050,443	55
56	376	25,799	490,331	25,611	477,431	5,560,020	56
57	411	25,423	464,532	25,218	451,820	5,095,395	57
58	455	25,012	439,109	24,784	426,602	4,656,184	58
59	498	24,557	414,097	24,308	401,818	4,241,974	59
60	536	24,059	389,540	23,791	377,510	3,852,310	60
61	574	23,523	365,481	23,236	353,719	3,486,695	61
62	609	22,949	341,958	22,645	330,483	3,144,594	62
63	644	22,340	319,009	22,018	307,838	2,825,434	63
64	678	21,696	296,669	21,357	285,820	2,528,605	64
65	712	21,018	274,973	20,662	264,463	2,253,463	65
66	745	20,306	253,955	19,933	243,801	1,999,331	66
67	777	19,561	233,649	19,173	223,868	1,765,497	67
68	810	18,784	214,088	18,379	204,695	1,551,215	68
69	841	17,974	195,304	17,553	186,316	1,355,710	69
70	871	17,133	177,330	16,698	168,763	1,178,170	70
71	898	16,262	160,197	15,813	152,065	1,017,756	71
72	922	15,364	143,935	14,903	136,252	873,598	72
73	942	14,442	128,571	13,971	121,349	744,797	73
74	958	13,500	114,129	13,021	107,378	630,434	74
75	968	12,542	100,629	12,058	94,357	529,566	75
76	971	11,574	88,087	11,088	82,299	441,238	76
77	966	10,603	76,513	10,120	71,211	364,483	77
78	954	9,637	65,910	9,160	61,091	298,332	78
79	932	8,683	56,273	8,217	51,931	241,821	79
80	901	7,751	47,590	7,301	43,714	193,999	80
81	862	6,850	39,839	6,419	36,413	153,935	81
82	814	5,988	32,989	5,581	29,994	120,732	82
83	760	5,174	27,001	4,794	24,413	93,528	83
84	698	4,414	21,827	4,065	19,619	71,512	84
85	633	3,716	17,413	3,399	15,554	53,926	85
86	564	3,083	13,697	2,801	12,155	40,071	86
87	495	2,519	10,614	2,272	9,354	29,317	87
88	425	2,024	8,095	1,811	7,082	21,099	88
89	359	1,599	6,071	1,420	5,271	14,922	89
90	298	1,240	4,472	1,091	3,851	10,361	90
91	240	942	3,232	822	2,760	7,056	91
92	191	702	2,290	606	1,938	4,707	92
93	147	511	1,588	438	1,332	3,072	93
94	112	364	1,077	308	894	1,959	94
95	81	252	713	211	586	1,219	95
96	59	171	461	142	375	738	96
97	40	112	290	92	233	434	97
98	27	72	178	58	141	247	98
99	18	45	106	36	83	135	99
100	11	27	61	22	47	70	100
101	7	16	34	12	25	34	101
102	4	9	18	7	13	15	102
103	3	5	9	4	6	6	103
104	1	2	4	1	2	2	104
105	1*	1*	2	1	1	..	105
106	1*	1*	1	..	..	..	106

* The values of l_{104}, l_{105}, and l_{106}, decimally carried out, are 2·490, 1·250, and 0·603; and their differences are 1·240, 0·647, and 0·325. The apparent anomaly, that no death happens between the ages 105 and 106, arises from the omission of decimals.

TABLE G.—*Healthy Districts Life Table.—The Mean After-Lifetime (or the Expectation of Life) at the Age x, and at the Age x and upwards; also the Mean Ages of the Living and the Mean Ages at Death (constructed from Tables D, E, F).*

PERSONS.					
Age (or past Lifetime).	Mean After-Lifetime of Persons of the Age x.	Mean After-Lifetime of Persons of the Age x and *upwards*.	Mean Age of Persons living of the Age x and *upwards*.	Mean Age at Death. Of Persons actually living at the Age x.	Mean Age at Death. Of Persons actually living at the Age x and *upwards*.
x.	$A_x=\frac{Q_x}{D_x}$.	$A'_x=\frac{Y_x}{Q_x}$.	$x+A'_x$.	$x+A_x$.	$x+2A'_x$.
0	49·00	33·92	33·92	49·00	67·84
5	54·16	31·98	36·98	59·16	68·96
10	51·08	29·91	39·91	61·08	69·82
15	47·12	27·85	42·85	62·12	70·70
20	43·45	25·82	45·82	63·45	71·64
25	40·05	23·79	48·79	65·05	72·58
30	36·64	21·76	51·76	66·64	73·52
35	33·17	19·73	54·73	68·17	74·46
40	29·64	17·71	57·71	69·64	75·42
45	26·05	15·71	60·71	71·05	76·42
50	22·44	13·74	63·74	72·44	77·48
55	18·86	11·84	66·84	73·86	78·68
60	15·37	10·04	70·04	75·37	80·08
65	12·29	8·37	73·37	77·29	81·74
70	9·61	6·86	76·86	79·61	83·72
75	7·34	5·51	80·51	82·34	86·02
80	5·51	4·36	84·36	85·51	88·72
85	4·10	3·41	88·41	89·10	91·82
90	3·05	2·65	92·65	93·05	95·30
95	2·29	2·05	97·05	97·29	99·10
100	1·72	1·47	101·47	101·72	102·94

Age (or past Lifetime).	MALES. Mean After-Lifetime of Males of the Age x.	MALES. Mean Age at Death of Males actually living at the Age x.	FEMALES. Mean After-Lifetime of Females of the Age x.	FEMALES. Mean Age at Death of Females actually living at the Age x.
x.	$A_x=\frac{Q_x}{D_x}$.	$x+A_x$.	$A_x=\frac{Q_x}{D_x}$.	$x+A_x$.
0	48·56	48·56	49·45	49·45
5	54·39	59·39	53·93	58·93
10	51·28	61·28	50·88	60·88
15	47·20	62·20	47·04	62·04
20	43·40	63·40	43·50	63·50
25	39·93	64·93	40·18	65·18
30	36·45	66·45	36·85	66·85
35	32·90	67·90	33·46	68·46
40	29·29	69·29	30·00	70·00
45	25·65	70·65	26·46	71·46
50	22·03	72·03	22·87	72·87
55	18·49	73·49	19·24	74·24
60	15·06	75·06	15·69	75·69
65	12·00	77·00	12·58	77·58
70	9·37	79·37	9·85	79·85
75	7·15	82·15	7·52	82·52
80	5·37	85·37	5·64	85·64
85	4·01	89·01	4·19	89·19
90	2·99	92·99	3·11	93·11
95	2·25	97·25	2·32	97·32
100	1·69	101·69	1·75	101·75

The Table may be read thus:—Persons in the Healthy Districts of England of the precise age 20 will live, on an average, 43·45 years; while persons of the age 20 and *upwards*, living in a normally-constituted population of the same character, will live on an average 25·82 years. The mean age of persons of the age 20 and *upwards* is 45·82 years; the mean age at death of persons living at the precise age 20 will be 63·45, while the mean age at death of persons actually living at the age x and *upwards* will be 71·64 years.